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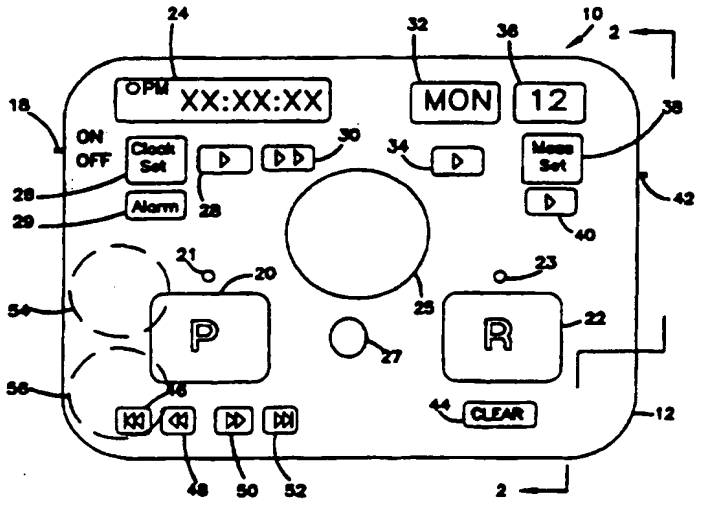

(57) Abstract

A credit card size record/playback apparatus (figure 1) which permits recording of audio information of at least two minutes in duration in a package configuration which is entirely self-contained is disclosed. In a preferred embodiment, the apparatus includes a suitable microphone (27) and speaker (25) for operation in record and playback modes, respectively. Liquid crystal displays for indicating time of day (24), date (32) and message count (36) and alarm or event plan capability may also be provided. Switches control the record (22) and playback (20) operations, as well as searching (46, 48, 50, 52) for and identifying different messages or message events contained in the recording. The invention may also be configured for operation in only playback mode, without recording over or erasing the recorded message, such as for use in conjunction with on-site marketing of products in retail stores (figures 12-13). A voice card version (figures 6-8) and a phone attached version (figures 10-11) are also disclosed.

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CREDIT CARD SIZE AUDIO RECORD AND PLAYBACK DEVICE

FIELD OF THE INVENTION

The present invention relates generally to a solid-state device for recording and playing back audio information, and more specifically to a credit card size device which can be used for recording and playing back voice and other audio information of at least two minutes in duration and without requiring any external devices such as power supplies, tape, recorders or the like.

BACKGROUND OF THE INVENTION

Ever since the advent of audio recording tape, there has been a continuing evolutionary process directed toward a reduction in the size of audio recorders. However, because of the requirement for moving an audio storage tape across a fixed recording or playback head, even the smallest of audio tape recorders requires a motor and at least one battery which prevent miniaturization beyond a minimum limit. Consequently, even with the tremendous advances in miniaturization of electronics over the last decade, audio recorders have remained relatively fixed in their level of ultimate miniaturization. Attempts to use solid-state memory devices to record audio information digitally, while doing away with the requirement for moving parts and the power requirements associated therewith, have run into another road block, namely, the requirement for mass amounts of memory capacity to store any significant period of information for later playback. However, a relatively recent innovation disclosed in U.S. Patent No. 4,989,179 assigned to Information Storage Devices, Inc. of Santa Clara, California has created a breakthrough in the art related to analog signal recording and playback. This patent discloses the use of an integrated circuit having an array of non-volatile memory cells to store audio signal information in analog form and to retrieve it on a real-time basis. Further development of this integrated circuit since the

issuance of that patent has produced a family of devices, offering single chip record/playback durations of up to 120 seconds with telephone quality voice reproduction.

The present invention is designed to exploit this new breakthrough in analog signal recording technology by providing a consumer product in the form of a credit card size package which has all the necessary user selective controls for recording and playing back at least two minutes of voice messages or other analog audio information. A product of that kind is believed to have numerous applications, including the attachment of such credit card size record/playback devices, to for example, a plurality of documents to provide the recipient thereof with a brief audio message describing the content, nature or purpose of those documents and the reason they have been sent. In other words, the present invention may be considered an audio replacement for the written Post-it® note, manufactured by the 3M company. However, the present invention, in its preferred embodiment, opens up a new consumer product field, namely the communication of brief audio messages in a package that is so small and inexpensive that it may be readily mailed or shipped in a configuration which may be readily operated by the recipient who need only press a button to hear an audio message and who need not supply a separate recorder or player to facilitate such communication.

There is no prior art known to the applicants which is capable of providing that function in such miniature form. The closest known capability comparable to that of the present invention is found in miniature audio tapes. However, such tapes require that the sender and the user each retain an apparatus for first recording and subsequently playing back the shipped audio tape. On the other hand, the present invention is, in its preferred configuration, an all encompassing unit which

is self-sufficient in that the sender records his message and sends the entire unit to the recipient who then plays the message back on the same unit. Because of its miniaturization characteristics, the unit adds virtually no weight to a package of documents. In any case, it may be shipped in a small envelope at extremely low postage rates because of its correspondingly low weight. Furthermore, because the present invention is relatively inexpensive, low in volume and entirely self-contained, it may be used as a memory source for archival message storage. For example, it may be used for storing cooking recipes, wherein each such credit card size audio analog recording device provides a brief but ample length message which describes the recipe for a particular type of food or meal and which may be re-recorded with a new message many times. A user may gain access to such recipe simply by pressing a button which is labelled "play". There is simply no prior art known to the applicants which can accomplish this function in such a miniature configuration and without requiring a large investment in larger, more expensive record/playback devices.

The present invention may also be configured so that a user can only play back a recorded message without recording or erasing that message. Such a configuration may be readily implemented by providing only a "play" switch, recording being accomplished only by connecting a suitable electric connector to the device and thereby recording a pre-selected message prior to public disbursement of the device. Such re-recordable, pre-recorded, play only configurations may have significant advantageous application in conjunction with on-site advertising and marketing of products available in retail stores.

Still another configuration using suction cups, may be readily affixed to cellular phones for conveniently storing audio messages such as phone numbers

communicated to the user during phone conversations. The thin, lightweight implementation disclosed herein, makes it uniquely suited for that purpose without adding any significant bulk or weight to the cellular phone.

SUMMARY OF THE INVENTION

The present invention comprises a credit card size record/playback apparatus which permits analog recording of audio information of at least two minutes in duration in a package configuration which is entirely self-contained, requiring no external power supply or other electronic devices with which to operate. In one preferred embodiment disclosed herein, the apparatus of the present invention utilizes an IDS Model 25120 single chip record playback device manufactured by Information Storage Devices, under the trademark "DIRECT ANALOG STORAGE TECHNOLOGY" or "DAST". It also uses a CMOS based 8-bit microcomputer controlled micro-controller which provides timing and status signals, as well as control, responsive to manually operated push buttons to record and play back analog audio signals.

The present invention also comprises a suitable speaker and microphone which are both integrated into the credit card size package of the present invention for operation in the record and playback modes, respectively. In a preferred embodiment of the invention herein disclosed, there is also provided liquid crystal displays for indicating time of day, day, alarm or event alert and message counter. Manually depressible switches are also provided for controlling the record and playback operations, message protection, as well as for searching and identifying different messages or message events contained in the recording, such as by scrolling either forward or backward through the stored message from message to message or within a message. The preferred embodiment of the present invention also provides an optional, detachable clip-type appendage so that the credit card size recorder may

be readily clipped to a document or to a shirt pocket or the like. In addition, a preferred embodiment employs a plurality of magnets built into the package, whereby the credit card size record/playback device of the present invention can be secured to any magnetic metal object, such as a filing cabinet or a refrigerator surface.

The present invention may also be configured so that a user can only play back a recorded message without recording or erasing that message. Such a configuration may be readily implemented by providing only a "play" switch, recording being accomplished only by connecting a suitable electric connector to the device and thereby recording a pre-selected message prior to public disbursement of the device. Such pre-recorded, play only configurations may have significant advantageous application in conjunction with on-site advertising and marketing of products available in retail stores.

A suction cup version is contemplated for direct attachment to cellular phones for recording critical messages therefrom.

OBJECTS OF THE INVENTION

It is therefore a principal object of the present invention to provide a miniature solid state audio signal record and playback apparatus which provides at least a minimum of two minutes of message recording and playback in a credit card size package that is entirely self-contained and includes all necessary power, microphone, speaker and switching to accommodate such recording and playback.

It is another object of the present invention to provide a credit card size solid state analog signal recording and playback device, which may be used for storing voice messages, the packaging thereof being sufficiently small in size to make it conducive to attachment to documents and the like forming a transmission medium in the form of a voice recording to

accompany such documents to explain the content thereof.

It is still an additional object of the present invention to provide an entirely self-contained solid state audio signal recording and playback device which is approximately the same size and shape as a standard credit card for permitting recording and playing back relatively brief audio messages of at least two minutes in length, such as for storing and relaying the content of a recipe upon the depression of a single push button switch and which because of its extremely low cost, can function in common business protocol, such as in the form of business cards, audio instruction device, document attached device description and the like.

It is still an additional object of the present invention to provide a miniature audio message re-recordable storage device in a credit card size configuration suitable for unique commercial application including on-site product advertising and the like.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of the present invention, as well as additional objects and advantages thereof, will be more fully understood hereinafter as a result of a detailed description of preferred embodiments when taken in conjunction with the following drawings in which:

FIG. 1 is a plan view of the front face of an audio signal record/playback device in accordance with the present invention;

FIG. 2 is a side view thereof;

FIG. 3 is an electrical block diagram thereof;

FIG. 4, comprising FIGs. 4a and 4b, is an electrical schematic diagram thereof;

FIG. 5, comprising FIGs. 5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, and 5j, is a flowchart diagram of software contained therein;

FIG. 6 is an isometric view of an alternative configuration of the present invention, utilizing a

desktop device;

FIG. 7 is a side view of the device shown in FIG. 7;

FIG. 8 is a plan view of a voice card used in the desktop device of FIG. 6;

FIG. 9 is an electrical block diagram of the desktop device show in FIG. 6;

FIGs. 10 and 11 illustrate an embodiment suitable for connection directly to a cellular phone;

FIG. 12 is a "play-only" configured embodiment of the invention suitable for advertising and marketing applications;

FIG. 13 is an exemplary illustration for advertising or marketing use of the embodiment of the invention shown in FIG. 12;

FIG. 14 is a plan view of a front face of another embodiment of the device of FIG. 1;

FIG. 15, comprising FIGs. 15a, 15b and 15c, are a block and electrical schematic diagram of a digital implementation in accordance with the present invention;

FIG. 16 is a perspective view of a preferred embodiment of the device of FIG. 6;

FIG. 17, comprising FIGs. 17a and 17b, is an electric schematic diagram of multiple ISD devices cascaded together;

FIG. 18 is a logic flow diagram of the cascading feature of FIG. 17;

FIG. 19 is a preferred embodiment of the device of FIG. 16;

FIG. 20, comprising FIGs. 20a and 20b, is a logic flow diagram for the device of FIG. 19;

FIG. 21 is a plan view of the front face of an interactive learning device;

FIG. 22 is a perspective view of a watch recorder;

FIG. 23 is a perspective view of a watch identification device;

FIG. 24 is a perspective view of another preferred

embodiment according to the present invention;

FIG. 25, comprising FIGs. 25a and 25b, is a perspective view of a console and mailer, respectively, for the device of FIG. 24;

FIG. 26 is a logic flow diagram for the device of FIG. 24;

FIG. 27a is a preferred embodiment of the device of FIG. 24;

FIG. 27b is a mailer for the device o FIG. 27a;

FIG. 28 is perspective view of a base station;

FIG. 29 is a perspective view of a multiple person message center; and

FIG. 30 is an overall block diagram for all of the embodiments described herein.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIGs. 1 and 2, it will be seen that a preferred embodiment 10 of the present invention comprises a recorder/player face 12 in a credit card size configuration of approximately 3.4 inches in width, 2.1 inches in height and no greater than 0.25 inches in depth. This configuration of the invention provides the following key features, master ON/OFF switch 18, play ("P") 20 and record ("R") 22 buttons, speaker 25, microphone 27, digital LCD clock 24, digital LCD display 32 of the day, a clock set button 26 and associated fast and slow forward buttons 30 and 28, a day set button 34 for associating an alarm time with a particular day, a message set button 38, an alarm button 29, a message set advance switch 40, a message protect switch 42 and a removable clip option 17. The master ON/OFF switch 18 may be left in the ON position most of the time, since the invention automatically powers down after playing or recording. The switch should be turned to the OFF position when protection from accidental power up is desired, such as in the situation where the product is sent in an envelope to a recipient. While ON/OFF switch 18 as shown is a mechanical switch, it can be

appreciated that the ON/OFF feature can be software controlled, incorporating automatic power up and power down functions.

The play button 20 is a momentary switch with a tactile feel that lightly clicks when pressed and released. This "soft" button initiates logic in the circuitry of a printed circuit board 16 which begins up to at least a two minute period of playing a previously recorded message or other audio input. Each time the play button is pressed and released, the recorded message begins again to completion. Play button 20 may also be configured to play all recorded messages when the user holds down play button 20 for greater than or equal to a pre-selected period of time. A user may play a particular message by scrolling through the recorded messages with message set advance switch 40 and pressing message set button 38 when the message number corresponding to the desired message is displayed across LCD display 36. When increment reverse switch 48 and increment forward switch 50 are pressed during playback of a message, the device automatically moves to the beginning of the previous or next message, respectively, and plays that message until completion.

The record button 22 is identical to the play button in operation and feel, with the exception that the additional hard switch on the right side of the product determines whether recording can occur. This message protect switch is actuated when the operator wishes to disable recording capability. While message protect switch 42 is shown as a hard switch, it can be appreciated that this function can also be accomplished through one or more software controlled buttons on face 12, such as a message protect button (not shown). Light emitting diodes 21 and 23 which are preferably of different colors, work in conjunction with the various features of the device so as to provide feedback to the user.

The speaker 25 may be a voice coil miniature speaker which operates as normal speakers do, such as those that are used in common audio equipment. The microphone 27 is an electric variety. Both the speaker and the microphone are low profile, quality miniature components which are clip on board configured, surface mount soldered or wired to the printed circuit board 16, behind the face 12 of the product 10. A piezo-acoustic generator may be used as both or either the speaker and the microphone elements.

The digital LCD clock display 24 provides an indication of the time of day and whether it is AM or PM. The digital LCD display 32 of the day, indicates the day of the week. The clock set button 26 permits adjustment of the clock time by using the associated slow and fast forward buttons 30 and 28, while clock set 26 is depressed. The day set button 34 may be depressed for scrolling through the days of the week, until the desired day is displayed. An alarm button 29 may be used in conjunction with the clock to set an alarm time. It may also be used with the day set button for setting an alarm day. The message set button 38 may be depressed for associating a particular alarm time and day to a particular message, such as for example, in message/alarms for advising the user of the time for taking certain medications. The alarm can be configured to either alert the user to push "play" in response to an audible sound or LED light or simply begin the playing of a selected message (i.e., "take your medication") at a pre-selected time.

The four switches 46, 48, 50 and 52 below the play button 20 are, observing them from left to right in FIG. 1, respectively, for reverse, increment reverse, increment forward, and forward. The reverse switch 46 may be used to skip to a previous message. The increment reverse switch 48 may be used to scroll through a particular message. The increment forward

switch 50 may be used to scroll forward through a particular message and the forward switch 52 may be used to skip to the next subsequent message in storage. Preferably, increment reverse switch 48 and increment forward switch 50 may also be configured to quickly move the user to either the beginning or end, respectively, of all messages recorded.

Clear button 44 may be used to erase the entire set of messages or a selected message when used with the record button 22.

FIG. 14 shows another preferred embodiment of the record and playback device 10 of FIG. 1. The device 10' of FIG. 14 provides many of the same features of device 10. Device 10' also includes a message waiting button 31, an erase button 33, an erase all button 35, a scramble button 37, an order button 39, and a bi-directional scroll button 5 which replaces message set advance switch 40 of FIG. 1. Message waiting button 31 allows users to alert themselves or others of important messages to be listened to. Once a message is recorded and message waiting button 31 is selected, the program automatically resets the location of next play to the beginning of all messages. All buttons on face 12' are then disabled except play button 20' and cannot be accessed until all recorded messages are played. One of LEDs 21' or 23' preferably begins blinking to indicate that an important message has been recorded. Once all recorded messages have been played, the LED is de-activated and all buttons on face 12' are re-enabled. It can be appreciated that the message waiting button can also be used to quickly rewind to the beginning of all messages.

In order to better prevent accidental erasure of all messages, clear button 44 of device 10 has been replaced with two buttons, erase button 33 and erase all button 35. Erase button 33 performs the selective erasing function of clear button 44, while erase all

button 35 performs the erasing of the entire set of recorded messages function of clear button 44. With the erase all function being on a separate button, the risk of inadvertent erasure of all messages is significantly reduced. Scramble button 37 allows a user to randomly scramble the order of recorded messages, while order button 39 allows the recorded messages to be re-ordered, whereby the re-ordering is preferably user-defined. Bi-directional scroll button 5 allow the user to scroll message numbers displayed via LCD display 36' in both a forward and a reverse direction.

As shown in FIG. 2, a wide plastic or metal clip 17 may be provided to facilitate easy connection of the invention to a group of papers, such as in intercompany mail or for explanatory notes associated with various documents to which the invention is attached. The clip 17 may also be used to attach the product to another surface, such as the visor above an automobile windshield. The clip 17 is preferably removable and when removed, leaves a flat backside surface. A plurality of magnets (not shown) may be provided on the backside surface 14, one in each corner thereof, flush mounted so that the invention can be attached to metal surfaces, such as a file cabinet or refrigerator door.

With further reference to FIG. 2, the audio signal storage device of the present invention comprises a front face 12, and a rear face 14. The faces 12 and 14 are separated by a printed circuit board 16. Furthermore, as seen in FIG. 1, the printed circuit board 16 provides a pair of battery terminals 54 and 56, which within the preferred embodiment hereof, comprise plus and minus terminals for receiving two 3-volt thin lithium batteries (not shown) connected in series to provide a 6-volt power source for the invention. In another preferred embodiment, four three (3) volt lithium batteries may be used, two each in series, and the two pairs in parallel to each other.

It can be appreciated, however, that other types of battery configurations can be used. For example, the batteries may be made of materials other than lithium, such as Ni-Cd, lead-acid or Nd-M-H, for example. Alternatively, printed circuit board 16 can be configured to receive a plurality of prismatic battery cells in conjunction with additional voltage step-up circuitry to provide the required power, as will be later described herein. In a preferred form, the step-up regulator is a Maxim Max 856 or equivalent.

Printed circuit board 16 may also include a battery charging circuit (not shown) and a port for charging the batteries when they become low. The device is preferably configured to beep and/or flash either or both of the LEDs on the face of the device to indicate to the user that the batteries are becoming low.

A block diagram of the present invention is shown in FIG. 3. As seen therein, the invention comprises two principal integrated circuit devices, namely an ISD25120 record and playback device and a Z86E40 controller. The record and playback device may be best understood by referring to a publication of Information Storage Devices, Inc. dated October, 1992 and entitled ISD2000 Family, Single-chip Voice Record/Playback devices, 60-120 Second Single-chip Durations. The model Z86E40 controller may be best understood by referring to the Zilog product specification entitled Z86E40 CMOS Z80TPCCP micro-controller in the Zilog 1991 publication entitled Zilog micro-controllers, beginning at page 487 thereof. As seen in FIG. 3, the record and playback device 63 is connected to the controller 62 which supplies the address, control and clock signals thereto. The record and playback device 63 is connected directly to the microphone 27 and to the speaker 25. The controller 62 receives input signals from the control panel 64 of the front face 16, in the form of selected manual depression of the momentary keys described

previously in conjunction with FIG. 1. The controller outputs signals to the LCD segment displays 66, as previously described in regard to FIG. 1. The red and green light emitting diodes 23 and 21 which display record and play status, respectively, are connected to the controller 62 as well.

The schematic diagram of one preferred embodiment of the invention shown herein is illustrated in FIG. 4, which comprises FIG. 4a and 4b. As seen in FIG. 4, the electronic circuit of the present invention comprises the aforementioned ISD25120 chip in its preferred embodiment, as well as the aforementioned Zilog Z86E40 controller chip. In addition, also shown in FIG. 4, is an HD44780 LCD dot matrix display driver connected to the LCD dot matrix displays described beginning at page 114 of the Hitachi LCD Controller/Driver LSI Data Book. Also shown in FIG. 4 are the manual push button switches which control the operation of the invention as previously described in conjunction with FIG. 1. A plurality of such switches are shown in the circuit of FIG. 4, namely time set, event set, clock forward, alarm ON/OFF, reset, record, play, stop, play message, pause, forward, reverse, reset, scroll backward, scroll forward, and repeat last.

The Z86E40 controller is a single chip architecture micro-controller with 4 kBYTES of EPROM memory and 236 BYTES of RAM housed in a 40 pin dual in-line package, manufactured in CMOS technology. It can be appreciated, however, that chip on-board technology could also be used to further miniaturize the device. It utilizes an eight bit micro-controller with an expanded register file to allow easy access to register map peripheral and I/O circuits. Thirty pins are dedicated to input and output functions. These lines are grouped into four ports, eight lines per port and are configurable for providing timing, status signals, and parallel input and output. There are four basic address spaces available

to support various configurations. These are program, memory, data memory, register file and expanded register file. The register file is composed of 236 BYTES of general purpose registers, four I/O port registers and 15 control and status registers. The expanded register file comprises three control resistors.

As shown in FIG. 4a, the controller is connected to an external parallel resonant and crystal, which in the preferred embodiment herein disclosed, is a 4.0 megahertz crystal for setting the clock rate of the controller at 1.0 megahertz. Each side of the crystal is in turn connected to electrical ground through a 22 microfarad capacitor labelled C10 and C1, respectively.

The record and playback device is connected to a volume control resistor R4 at its speaker output terminals. R4 is a potentiometer-type resistor, the center tap for which is connected to an LM386 amplifier. The output of the amplifier is connected to a suitable speaker as previously described. The microphone output terminals of the record and playback device are connected through capacitors C4 and C5, to a suitable microphone, one terminal of which is connected through an RC network, consisting of resistors R5 and R6 and capacitors C7 to VCC, the 6 volt supply. The AGC terminal of the record and playback device is connected to an RC parallel network comprising resistor R7 and capacitor C6. The analog output and input terminals of the device are connected to a capacitor C9. VCC is a 6-volt supply derived from the two batteries shown in the upper right hand corner of FIG. 4b. Each battery provides three volts and the two batteries are connected in series with switch J4 which is the ON/OFF switch 18 shown in FIG. 1. A significant feature of the present invention is the extended battery life due to extremely low leakage current which provides virtually limitless non-volatile storage of audio and control signals. The various interconnections between the controller and the

record and playback device include address signals for addressing the memory storage location in the record and playback device where messages are to be recorded or played back. Also provided in that interface are control signals for control of the record and playback device, including play and record as well as chip enable (CE), and end of message (EOM).

FIGs. 3 and 4 show an analog implementation of the invention. While certain embodiments throughout the application have been described using analog circuitry, it can be appreciated that such circuitry can be easily replaced with digital circuitry. The block diagram for the digital implementation of the invention is shown in FIG. 15a, while the schematic for the circuitry for the digital implementation of the invention is shown in FIGs. 15b and 15c.

Referring to FIGs. 15a, 15b and 15c, the invention preferably includes a controller 500, a voice recording/playback compression chip 502, and at least one memory device 513 for storing the source code for the application program. Preferably, controller 500 is a Microchip PIC17C42 controller chip, voice chip 502 is an OKI MSM 6788VT, ADPCM solid state recording chip, and memory device 513 is an ATMEL AT29LV040 Parallel Flash PEROM (non-volatile). The circuit also preferably includes at least one on-board memory device 504 and at least one removable memory device 526. On-board memory device 504 may be any volatile or non-volatile memory device, such as DRAM, SRAM, NVRAM, Flash PEROM and EEPROM, while removable memory device 526 is non-volatile. The user interface 510, represented by the buttons provided on the face of the record and playback device as previously described herein, is accomplished by momentary push button switches connected to controller 500. Controller 500 also controls, in conjunction with other devices, the handling of data between any memory devices connected thereto.

The circuit may further include a voice ROM 501 for storing pre-recorded prompts which are accessed upon user selection of the various features provided by the device. For example, upon pressing forward increment button 50, an audio announcement of the message number would occur indicating which message the user was on, such as "one" or "three" or "five", etc. Voice ROM 5012 is preferably an OKI MSM6596. A voice recognition chip 503 may also be provided for allowing operation of the device via voice commands. For example, if the user says "record", the unit would automatically begin recording. The voice recognition may be either or both trained by a given user, or robust to the extent that voices from any user may be recognized. Voice recognition chip 503 is preferably a Toshiba TC 6658A.

The circuit also includes an LCD panel display 506 which is driven by an LCD driver controller 508, such as an OKI MSM 6262GS. Power is supplied to the various devices in the circuit by a plurality of batteries 516, such as lithium or rechargeable Ni-Cd/NiMH batteries, which are stepped up to around 3.3 to 5 volts by using a step up regulator circuit 514, such as a Maxim 856 chip. The output from step up regulator circuit 514 is connected to the VDD and ground of the devices mentioned above. A low power indication signal is provided by step-up regulator circuit 514 to controller 500, which then turns on one of LEDs 511 or 519 connected to controller 500. These LEDs may also be used to indicate other events. The crystal 512 connected to oscillator one (1) and oscillator (2) of controller 500 can be chosen between about 32 Khz to 20 Mhz to set the clock rate for the device.

Some of the input/output lines from controller 500 are shared on a common bus. Removable memory devices 526 and voice chip 502 are connected to controller 500 on the common bus. A microphone 505 is connected to controller 500 through a 2907A transistor. Switches 507

and 509 control microphone 505 and a speaker 517. Microphone 505 is turned on and off by the transistor and is controlled by controller 500 through the base of the transistor. The input of microphone 505 is connected to MIN of voice chip 502 through a capacitor, such as a blocking capacitor. The signal is amplified by a two stage amplifier and the gain is adjusted to suit the various applications using the feedback resistors connected to MIN/MOUT and LIN/LOUT of voice chip 502. The analog output is connected to a speaker amplifier 522, such as an OKI MSC1191. A digitally controlled volume control resistor 518 is provided to adjust the volume level. Speaker 517 is connected to the Sp+ and SP- terminals of speaker amplifier 522. The DIN input can be connected to the controller 500 to provide audio beeps for the various user interface functions.

The voice and/or other data stored on the memory devices of the circuit can also be accessed directly from controller 500 for interface to outside systems. All of the items described above are commercially available as is known to those skilled in the art.

FIG. 5, comprising FIGs. 5a through 5e provides a logic flow chart of the message play/record and event planner operation of the invention. As shown therein after power on at 250, the micro-controller initializes the message counter and address pointer, updates the LCD display of message count and loads address bits at 255. At 260, scan operations for a key contact (button depression) is carried out, while at 265, scan operations for an event planner (alarm) time setting is carried out.

If a record key is depressed, the program in the micro-controller carries out the operations depicted in FIG. 5b. If, at 273 the record key is pressed, at 275, the program scans for the stop key, turns on the timer, activates the record LED, displays record time remaining

and sets the control signals for activating record mode in the record and playback message storage device and activating other LED signalling functions such as low battery.

At 280, the stop key is continually monitored while at 285 message record time is simultaneously checked. When either the stop key is depressed or message time expires, at 290 control signals are reset, record LED is turned off, the timer is turned off and the remaining record time available is calculated. At 295, if the remaining record time is less than or equal to 3 seconds, the message count is checked at 300 and either updated at 305 (if empty) or not updated at 310 (if not empty), the message display is updated accordingly and the next message address is loaded into a register in the micro-controller for subsequent operation. If more than 3 seconds of recording time remain, at 315 the message count is increased by one, a new message address (spaced one-half second from the newly recorded message end) is loaded into the appropriate register and the display is appropriately updated. In either case, the program returns to the key scan operation shown in FIG. 5a.

The play, forward, reverse, scroll forward, scroll backward and repeat last operations are shown in FIG. 5c. If the play key has been pressed at 317, at 320 the stop key is scanned, the play LED is turned on and the control signals for play operation of the record and playback message storage device are set until either the stop key is depressed at 325 or the EOM (end of message) bit is detected at 330. In the latter case, the control signals are reset, the message count is advanced, the next message address is loaded into the register and the display is updated at 335. In either event, the program returns to the key scan operation shown in FIG. 5a.

Upon pressing each of the other forward and backward operations indicted in FIG. 5c at 345, 350,

355, and 360, all keys are deselected, message count registers and display are adjusted appropriately (i.e., full message increment or decrement or 2 second increment or decrement of message address) at 370, 375, 380, and 385, respectively. Then at 400, the program returns to key scan. If the repeat last key is pressed at 365, the keys are deselected at 390 and at 395, the message count is checked to determine if it is greater than one and if it is the previous message count is fetched, addresses and display are updated and the program returns to the play operation to replay the previous message.

The pause operation and clear message operation are shown in FIG. 5d. Upon pressing the pause key at 410, at 420 all keys except stop are deselected, the current message count is stored, the address of the current location is calculated and stored, control bits for the operation mode and enable status of the record and playback message storage device are set, the timer is turned on to assess elapsed time and the pause key is set and checked continuously. If either the pause key is no longer depressed at 425, or the elapsed time exceeds 10 seconds or the stop key is depressed at 430, at 435 and 440, respectively, control bits are set, the timer is turned off and the program returns to key scan operation. Otherwise, the elapsed time and pause key continue to be checked.

Upon pressing the clear key at 415, at 445 all keys are deselected, message count and message address register are cleared and the program returns to key scan in FIG. 5a. If none of the aforementioned key operations are detected, the program eventually turns off the power automatically at 450, as seen at the bottom of FIG. 5d.

FIG. 5e depicts the operations for the alarm (event planner) feature of the embodiment of the invention shown in FIGs. 1-4. If the select event planner

operation is selected at 455, at 460 the program deselects all keys, sets the time and date and message count at 465, and sets the alarm on at 470. It then checks for alarm on at 475 and if it's on, at 480 it beeps (sends beep tone to the speaker and waits for the beep to be turned off by the user). When that occurs, at 485 the program loads the message count and registers with appropriate addresses for the planned message, scans for stop and turns play mode on. Unless stop is depressed at 490, the program carries out the play operation shown in FIG. 5c. If stop is depressed, the program returns to the initializing step in FIG. 5a.

FIG. 5f depicts a preferred embodiment of the play operation shown in FIG. 5c. While this embodiment can be used with either device 10 of FIG. 1 or device 10' of FIG. 14, for the purposes of discussion, the discussion will be directed to device 10' of FIG. 14. Once the user approaches the unit at 530, he or she chooses to enter the play mode at 532. If the user does not wish to play a message, at 540, he or she may perform any other functions previously described herein. If the user decides to enter the play mode, at 534 the user may have to enter the message waiting mode if a message is waiting. If a message is waiting, all buttons on the face of the device are disabled until all of the messages are played to completion. At 536, the user presses play button 20', at which time all messages begin to play. If at 538 the user interrupts the playback of all messages, such as by trying to press a button, at 539 play is stopped and the user is returned to the message waiting mode at 536. Once all the messages have been played, the user is returned to 532 where he or she may perform additional functions.

If the device is not in the message waiting mode, at 542 the user may choose the location at which he or she wishes to start playing. If the user is already at the desired location, the user has the option at 544 to

either play the message at that location or to play all recorded messages. If the user wishes to play the message at that location, he or she simply presses play button 20' at 546. All recorded messages can be played by holding play button 20' down for greater than or equal to a pre-selected period of time, such as one (1) second.

At 550, the user has the option to play the entire message. If the user wishes to play the entire message, the entire message is played and the user is returned to 532. If the user does not wish to play the entire message, the user may either stop play at 552 or skip to the next or previous message at 554. The play process can be stopped by pressing play button 20' again, at which time play discontinues and the pointer is reset to the beginning of the message that was last playing. A user can automatically skip to the next or previous message at 538 by pressing increment forward switch 50' or increment reverse switch 48', respectively. At 560, depending on which switch was pressed, the next or previous message is played to completion, after which play stops, the pointer is moved to the end of the played message, and the user is returned to 532.

If the user does not wish to stop play or skip to the next or previous message, at 562 the user can scroll forward or backward within a message while play is occurring by pressing forward switch 52' and reverse switch 46', respectively, whereby at 564, the position of play is moved about two (2) seconds in the direction selected, after which the message continues until completion and play stops.

If at 542 the user is not at his or her desired position, at 566 he or she may move to either the first or last recorded message. At 568, the user may fast rewind to the first message by pressing increment reverse switch 48' and holding it down for greater than or equal to a pre-selected period of time, such as one

(1) second. The user may fast forward to the last message in a similar fashion via increment forward switch 50'.

If the user wishes to select a particular message, at 570 he or she may scroll to that message by pressing forward switch 52' or reverse switch 46'. Once the desired message is found, the user is returned to 544 where he or she may play the message as previously described herein.

FIGs. 5g, 5h, and 5i depict the operations for the record and erasing features for both analog and digital implementations in a direct addressing mode via time, for an analog ISD 2500 series device in the pushbutton mode, and for the digital implementation in a direct addressing mode by memory location, respectively. The unique and novel programming techniques associated with these functions allow playback and record devices incorporating such techniques to provide essentially an endless loop of recording not otherwise available, as well as simple access to all record and play functions.

The programming techniques involve the use of tables, tags, memory manipulation and background timing. Tables for memory locations, durations and message numbers are generated and updated by the controller and stored therein for future use. Tags may be either a description of a location in memory or signals associated with specific memory locations that provided such information, such as the location of message start or end, as well as the end of the last message in memory. Further, by using either descriptions of memory locations or background timing that also defines such locations, sectorization of memory can occur, whereby non-continuous sectors may be used for message recording. In this manner, memory can be fragmented, and yet used in a continuous recording mode.

As shown in FIG. 5g, at 600, the user may select whether to record a message. If the user does not wish

to record a message, at 602, the user may select whether to erase a message. If the user wishes to erase a message, at 604, the user may select whether to erase all messages, or only a particular message. The user may erase all messages at 606 by pressing erase all button 35 and holding it down for a pre-selected period of time, such as one (1) second. At 608, one of LEDs 21' or 23' blinks to indicate when all messages have been erased. The user may erase a particular message at 610 by scrolling through the messages via increment reverse switch 48' or increment forward switch 50' until the message number corresponding to the desired message is displayed across LCD display 36', and selecting that message by pressing message set button 38'. As a security measure, erase button 33' is disabled until the user plays a portion of the message to verify that the message selected is in fact the message he or she wishes to erase. After a portion of the message has been played, the message can be erased by pressing and holding erase button 33'. In a preferred form, one of LEDs 21' or 23' begins flashes once the selected message has been completely erased. At 612, the program automatically deletes the selected message from the table, resequences the messages, and tags where the next available recording sector is located, thereby freeing erased sectors for future recording, even though the erased sectors are not in contiguous locations.

If the user wishes to record a message, at 614 the user presses record button 22' to begin recording. At 616, the program automatically segments the memory into small sectors, each sector having its own address. The program then loads the address of the longest available group of sectors, as well as the message number corresponding to the last recorded message. The background timer is turned on and then the ISD recording function is turned on. In the case of multiple memory devices, at 618, the user may decide whether he or she

would like to continue recording. If so, at 620, the program automatically determines whether the current memory device is full. If so, at 620, the program automatically turns on the next memory device and continues recording. The program continually checks whether the current memory device is full at 624 and turns the next memory device on until no more memory devices are available. If no more memory devices are available, at which time one of LEDs 21' or 23' will blink to indicate that all memory has been used up.

Recording is stopped by pressing record button 22' again at 626. At 628, the program automatically turns the timer off, calculates the next address location for the next available message block and tags that address, increments the message counter by one, and then turns the ISD record function off.

FIG. 5h depicts the operations for the record and erasing features for an ISD 2500 using the pushbutton mode. At 630, the user may select whether to record a message. If the user does not wish to record a message, at 632, the user may select whether to erase all messages. If the user wishes to erase all messages, at 636 the user presses and holds erase all button 35, and at 638 one of LEDs 21' or 23' blinks to indicate all messages have been erased. Otherwise, the user may erase the last recorded message, at 640 by pressing erase button 33, upon which at 642 the program automatically deletes the message from the table and positions the pointer to the end of the message preceding the erased message. Once positioned, the program automatically records a short message, typically a few milliseconds long, so that two EOM markers are close together. This double flag indicates that the message before the pointer is the last message.

If the user wishes to record a message, at 644 the user presses record button 22' to begin recording. At 646, the program automatically activates the push-button

mode and scans for two EOM flags close together in order to find the last recorded message. The pointer is then advanced to the message proceeding the last message and the ISD record function is turned on.

In the case of multiple memory devices, at 648, the user may decide whether it would like to continue recording. If so, at 650, the program automatically determines whether the current memory device is full. If so, at 652, the program automatically turns on the next memory device and continues recording. The program continually checks at 654 whether the current memory device is full and turns the next memory device on until no more memory devices are available.

Recording is stopped by pressing record button 22' again at 656. At 658, the program automatically turns the ISD record function off, increments the message count by one, and records a short message so as to place two EOM markers close together to locate the last recorded message during the pushbutton scan.

FIG. 5i depicts the operations for the record and erasing features for a digital implantation of the present invention using direct addressing by memory location. With this technique, address location is done based on memory location, rather than strictly time. At 750, the user may select whether to record a message. If the user does not wish to record a message, the user may either choose to erase a selected message at 754, or erase all messages at 754. If the user chooses to erase all messages, at 756, the program automatically deletes the message numbers from the table, tags all sectors available, and turns the memory refresh circuit of the controller off. If the user wishes to erase a selected message, at 758 the user can scroll through the messages via reverse switch 46' and forward switch 52' until the message number corresponding to the desired message is displayed across LCD display 36' and select that message by pressing message set button 38'. As a security

measure, erase button 33' is disabled until the user plays a portion of the message to verify that the message selected is in fact the message he or she wishes to erase. After a portion of the message has been played, the message can be erased by pressing and holding erase button 33'. In a preferred form, one of LEDs 21' or 23' begins flashes once the message has been completely erased.

At 760, the program automatically deletes the selected message from the table, resequences the messages, and tags where the next available recording location is, thereby freeing erased sectors for future recording, even though the erased sectors may not be in contiguous locations. Alternatively, the program can automatically read data beyond erased sectors and rewrite them into the first available erased memory location, so that all data will be compressed, such that free recording space is contiguous.

If the user wishes to record a message, at 762, the user presses record button 22' to begin recording. At 763, the program automatically segments the memory into small sectors of time, each sector of time having its own memory address (e.g., memory address locations for the beginning of each sector). Preferably, such time sectors range between 0.1 to 0.3 seconds. The program then prepares the table for the message number and sectors, loads the start address of the longest available group of time sectors, as well as the message number corresponding to the last recorded message. The background timer is turned on and then the controller turns on the record function. In the case of multiple memory devices, at 764, the user may decide whether it would like to continue recording. If so, at 766, the program automatically determines whether the current memory device is full. If so, at 768, the program automatically turns on the next memory device and continues recording. The program continually checks

whether the current memory device is full and turns the next memory device on until no more memory devices are available.

Recording is stopped by pressing record button 22' again at 772. At 774, the program automatically turns the record off, increments the message counter by one, stores the record end address pointer, tags the message number to sections used, and then goes into standby, whereby all devices are automatically out in a low power mode so that power is conserved.

FIG. 5j displays a logic flow diagram for the scramble and reordering operations of the device of FIG. 14. At 900, the user may choose to scramble the order of the recorded messages. The order of the recorded messages are randomly scrambled at 902 by pressing scramble button 37'. The program automatically randomly reorders the recorded messages at 904. At 905, the user has the option to listen to the scrambled messages. If the user decides not to listen to the messages, he or she may perform other functions as previously described herein at 907. Upon selecting play button 20' at 906, messages are played in random order at 908 either one at a time, or all at once if play button 20' is held for greater than or equal to a pre-selected period of time, such as one (1) second. At 910, the user has the option to reorder the scrambled messages back into the original order by pressing reorder button 39' at 912. The user has the option to listen to the messages in the original order at 914 by pressing play button 20' at 916, but not after another message is recorded. If the user does not want to listen to the reordered messages, he or she may perform other functions as previously described herein at 907.

At 918, the user may select whether to continue scrambling the recorded messages. If the user wishes to continue scrambling the recorded messages, he or she is returned to 900. If the user does not wish to scramble

the order of the recorded messages, he or she may reorder the messages at 920. If the user does not wish to reorder the messages, at 922 he or she has the option to perform other functions. If the user wishes to reorder the recorded messages, at 924 the user scrolls to the message to be reordered. For security purposes, at 926, the user listens to all or part of the message to confirm that the selected message is in fact the desired message to be reordered. At 928, the user presses message set button 38' to select that message. At 930, the user presses reordered button 39' to set the message number of the selected message to one (1). At 932, the user has the option to do more reordering. If desired, steps 924, 926 and 928 are repeated as represented by steps 934, 936, and 938, respectively. However, at 940 the user presses reorder button 39' to set the message number to the next message number (i.e., 2 and so forth). At 942, the user has the option to do more reordering and is returned to 924.

An alternative embodiment of the invention is shown in FIGs. 6 through 9. Unlike the embodiment of Figs. 1 through 4, the embodiment of FIGs. 6 through 9 is not designed for self-contained use, in that each card of the embodiment therein is designed to be installed in a console unit, the latter providing the speaker, microphone and control switches, in order to record and playback the contents of the analog storage device on the card. Accordingly, as shown in FIGs. 6, 7 and 8, this alternate embodiment of the invention 70 comprises a console unit 72, into which two voice cards 74 and 76 are partially inserted. Console 72 is connected to a rear support member 73, which provides a convenient means for stable support of the console on a flat surface, such as a desk and the like. Rear support member 73 may contain all or some of the electronics associated with the operation of the voice cards, including the batteries or alternating current

conversion device which may be used with console 72.

As shown best in FIG. 6, console 72 provides a speaker 78, a microphone 80, a pair of control panels 82 and 84, one for control of each voice card and corresponding LED indicating lights 85 and 86. In addition, a volume control 88 is provided. Furthermore, a record LED indicator 90 and 92 is provided for each of the voice cards. As shown in FIG. 7, each voice card 74 and 76 is inserted into a corresponding slot 75 and 77, respectively, within the console 72, where a plurality of contacts 94 on the voice cards are electrically connected to corresponding connectors 95, within the slots of the console 72. As shown in FIG. 8, the connectors 94 may be in a rectangular array as further delineated in FIG. 9. A plurality of reference arrows 98 provide the user with a clear indication of the direction in which the cards are installed in the console.

The electrical interconnectors between the card 74 and 76 and the console 72 may be best understood by referring to the schematic block diagram of FIG. 9. As seen in FIG. 9, each voice card 74 and 76, comprises a record and playback analog signal storage device of the type hereinbefore described and in Zilog Z86E30 micro-controller, also of the type hereinbefore described. In addition, it will be seen that the console 72, in addition to providing the speaker, amplifier, microphone and LED indicators previously described in conjunction with FIGs. 7 through 9, also provides a Zilog Z86E40 micro-controller 98 for controlling interface between the two cards, 74 and 76.

As seen further in FIG. 9, the control panel 82 provides manual switches for record, play, stop, pause, preview, next, scrolling forward, scrolling backward, message protection and selection of the A card or main card. A control panel 84 provides manual switches for copying, selecting the B card or backup card, playing,

stop, pause, preview, next, scrolling forward and backward and message protection. Each of the manual switches on control panels 82 and 84 is applied as an input to the cards 74 and 76 through the contacts 94 on the cards 74, 76 and the connectors 95 in the console. The output of card 74, labelled speaker+ and speaker- in FIG. 9, is applied to a micro-controller controlled switch 99, which in one position, connects the output to the speakers 78 through volume control 88, through an amplifier 79. In the other position of switch 99, the output of the speaker terminals of main card 74, are applied to the microphone input connectors of backup card 76 and the output speaker terminals of card 76 are applied to switch 99, terminals A and B which are connected to the speaker 78 through the amplifier 79 and volume control 88.

Thus it will be seen that the console configuration shown in FIG. 9, is designed to record and playback messages on main card 74, as well as to copy the contents of the record and playback analog signal storage device on card 74, into the corresponding record and playback analog signal storage device on card 76. Alternatively, the console of FIG. 9 may be used to simply play the stored analog signals in card 74. This embodiment of the invention is deemed to be especially advantageous for use as a convenient communication and copying device where messages are transmitted on credit card size voice cards, such as cards 74 and 76. Each such card is thinner and lighter and less expensive than the embodiment of the invention shown in FIG. 1, because it contains only the two integrated circuit chips and the necessary contacts to interface with the console connectors and does not have to contain batteries, microphone, speaker or the other attendant features of the first embodiment of the invention. Thus for example, one may use the console 72 of FIG. 9 to create a short message of up to 2 minutes in duration,

recording it on a voice card, such as card 74 and transmitting it by mail through interoffice or intra-office delivery, where it may be inserted into another console 72 and played to communicate a message stored therein and if desired, copied onto a backup card, such as card 76, by means of the console controls described in FIG. 9.

FIG. 30 shows an overall block diagram covering the base technology previously described herein, as well as additional components that support further embodiments as will be later described herein. As can be seen from FIG. 30, many of the components include those described in FIG. 15a, and thus a discussion of those components will not be repeated.

In addition to these components, the block diagram also includes a text-to-speech processor 579, such as a Toshiba TSP50C10, which converts alphanumeric data to speech. A modem chip 581 is also provided in conjunction with a DAA interface 583 for providing an interface for remote communications with a main host 587 over a phone line 585, preferably facilitated by software which automates the entire procedure.

FIG. 16 shows a preferred embodiment of the device shown in FIG. 6. Like device 70 of FIG. 6, the device 70' as shown in FIG. 16 includes a console unit 72', preferably in a credit card size configuration as the device 10 of FIG. 1. Console 72' provides a speaker 78', a microphone 80' and a plurality of LED indicators 90' and 92'. Console 72' also provides a play button 20', a record button 22', an erase button 33', an erase all button 35', and an LCD display 24'.

Console 72' also provides a plurality of slots 75' and 77' for receiving a plurality of removable non-volatile memory cards 74' and 76'. These memory cards provide additional memory to the on-board memory of device 70'. Memory cards 74' and 76' are preferably non-volatile memory, such as NVRAM, flash and EEPROMS.

Each card 74' and 76' contains a plurality of contacts 94' which electrically connect to corresponding connectors (not shown) within slots 75' and 77' when inserted therein. Preferably, cards 74' and 76' include up to thirty two (32) contacts in order to accommodate both serial and parallel interfaces, in order to accommodate ISO 9000, PCMCIA, and other standards. Console 72' also includes slots (not shown) for receiving a plurality of batteries 54' and 56' which are preferably prismatic battery cells.

The on-board memory and memory cards used in device 70' can be either digital as shown in FIGs. 15a and 15b, or analog as shown in FIGs. 17a and 17b. FIGs. 17a and 17b show a schematic of a circuit that includes an on-board memory device 71' and removable memory devices 74' and 76' connected in series. The circuit also includes a plurality of MOSFETS 73 communicating to each of these devices through the controller in such a manner that each device is turned on one at a time by the controller, with no two devices be on at the same time. The circuit also includes a plurality of MOSFETS 75 connected to the speaker of each device such that the speaker connection associated with each device is only turned on for one device at a time.

As is shown in FIG. 17a and 17b, the ISD devices are cascaded together in order to provide longer recording times. However, current ISD cascading techniques require that each ISD device be powered up simultaneously, thereby requiring a significant increase in the amount of power necessary to run device 70'. For example, if two ISD devices each require 30 milliamps of power, device 70' must have at least 60 milliamps of power to accommodate both devices.

FIG. 18 shows a logic flow diagram of a new cascading technique that allows the addition of multiple analog ISD devices to be used without the need for additional power beyond that needed for any one ISD

device. This technique allows for switching from one ISD device to another with no noticeable transition between each device, such that one device is powered up as another device is powered down. It also provides for such switching without loss of data. In addition, this technique permits longer recording times, typically ranging between three (3) to thirty (30) minutes. It can be appreciated, however, that longer or shorter recording times are possible.

Referring to FIG. 18, at 700, the controller checks for the number of ISD devices present. At 702, once the number of ISD devices has been checked, the controller instructs the first ISD device to start recording. At 704, the start address is loaded into the first ISD device and the background timer and the first ISD device are turned on. At 706, the controller checks whether the end of chip bit for the first ISD device is set high (i.e., whether the first ISD device is full). If not, the ISD device continues recording and checking until the first ISD device is full. Once the first ISD device is full, at 708, the controller automatically powers down while the next ISD device powers up, so that additional recording can be performed. Such a transition is virtually seamless to the user. At 710, once the desired message has been recorded, the timer is turned off and the controller instructs the ISD device to stop recording. The controller then calculates the address location for the EOM and increments the message counter by one. The controller is then ready to instruct the ISD device to record the next message.

Due to the increased recording time of device 70', device 70' must manage more messages. In order to help manage the increased number of messages, such messages can be grouped into a database. While any type of database may be used, for the purposes of discussion, it will be assumed that the database used by device 70' is a two dimensional database.

In this regard, console 72' also provides a database accept button 91, and a plurality of database navigation buttons 93a, 93b, 93c and 93d. The controller is configured to dynamically partition on-board memory 71 of device 70' and memory cards 74' and 76' so that messages may be captured into a plurality of message categories. Such categories are preferably user-defined and may include, for example, phone numbers, action items, important dates, medical data, emergency numbers and the like.

The user sets up and navigates through the database via the navigation buttons as shown in FIG. 16. The user can enter the set up procedure to set up user-defined categories by pressing and holding enter button 91, at which time menu prompts guide the user to create the desired categories. The database may contain alphanumeric (i.e. ASCII) and/or voice data. Alpha-numeric data may be input via menu prompts displayed on LCD display 24' in conjunction with the navigation keys. Voice data can be input through record button 22' as previously discussed herein.

Data is retrieved from the database by first scrolling through the user-defined categories via left or right navigation buttons 93a or 93b and selecting a category via database accept button 91. The user can then search through the data within the selected category through up and down navigation buttons 93c or 93d. Alphanumeric data can be read from display 24', while pre-recorded voice data can be broadcast via speaker 78'. In addition, device 70' also preferably includes a text-to-speech processor (see FIG. 30) so that, for example, ASCII data can be converted to voice data and broadcast via speaker 78'. With such a configuration, alphanumeric and voice data may be combined in a customized manner, thereby providing flexibility and convenience to the user during operation of device 70'.

Each of the buttons on console 72' is applied as an input to cards 74' and 76' through contacts 94' when electrically connected to connectors (not shown) in console 72'. Device 70' automatically powers up upon user selection of one of the buttons on console 72', and automatically powers down when no buttons have been selected within a pre-selected period of time. Like device 70, device 70' also allows for the transfer of data between all memory devices.

FIG. 19 shows a further embodiment of the device 70' of FIG. 16 The device 70'' includes all of the features of device 70', as well as a database update button 99, an enter button 107, and a phone jack 101 for providing the device with an automatic modem interface for uploading and downloading voice and/or other data between the device and a remote computer host 107 across a phone line 585'. With this configuration, the on-board memory and memory cards 74'' and 76'' preferably contain various databases, such as, for example, official airline guides, (OAGs) the yellow pages, medical directories, catalogs, recipes, datasheets, directories and the like. By inserting a memory card into the device and selecting database update button 99, device 70'' is programmed to automatically dial computer host 107 which contains the latest version of the respective database and automatically updates the inserted memory card with any changes, deletions and additions.

When accessing a database on one of the memory cards, visual and/or audio prompts guide the user through the database. For example, in the case of OAGs, such prompts would ask for information such as date and time of travel, originating city, destination city and the like. Responses would occur on the display 24'' giving choices of flights and fares based on the information provided by the user. Preferably, the on-board memory of device 70'' includes an audio "scratch

pad", so that the user can make verbal notes while accessing information from the database.

FIGs. 20a and 20b show a preferred logic flow diagram for device 70'' of FIG. 19 using an OAG database, for example. Throughout the logic, prompts are generated by the device to aid the user during operation of the device. Such prompts may be visual (e.g., displayed via LCD display 24'') and/or audio (e.g.,broadcast through speaker 78''). For discussion purposes only, it will be assumed that all prompts generated by the device are displayed across LCD display 24''.

At 800, a user may select whether to enter set up information, such as the current time and date. If the user selects to set up such information, at 802, the user presses left or right navigation buttons 93a or 93b until the "Setup" option is displayed across LCD display 24'', and at 804 selects enter button 107. At 806, menu prompts are generated to guide the user through the set up procedure. At 808, the user enters set up data in response to the prompts generated. The user may also make choices, such as whether ASCII to voice conversion is necessary. Once the setup is complete, at 810, the user selects enter button 107 again to exit the set up procedure.

If set up information has already been entered or the user decides not to enter set up information, at 812, the user may access the database. The logic flow diagram for accessing a database is shown in FIG. 20b. Preferably, user patterns are automatically updated into the database upon accessing the database at 814. Such user preferences may include, for example, preferred travel originating location or preferred travel times. These preferences would be displayed first when the database search is completed.

At 816, the user may select to enter travel originating information. Travel originating information

is entered by pressing left or right navigation buttons 93a or 93b at 818 until the option "From" is displayed and selecting enter button 91' at 820. At 822, the user may scroll through the available travel categories preferably in alphabetic order via left and right navigation buttons 93a or 93b until the desired category is displayed. The navigation buttons are preferably configured to increase scrolling speed when held down. The desired location may then be selected by selecting enter button 91' at 824, and scrolling through up and down navigation buttons 93c or 93d until the desired location is displayed across LCD display 24''. The desire location can then be selected at 828 by pressing enter button 107.

At 827, the user may select to enter travel destination information. Travel destination information is entered by pressing left or right navigation buttons 93a or 93b at 829 until the option "To" is displayed and selecting enter button 91' at 828. A location is then selected in the manner described above.

At 830 the user may choose to display the results. The user may display the results by pressing left or right navigation buttons 93a or 93b at 832 until the option "Results" is displayed, and by selecting enter button 91' at 834. The results may be viewed via display 24'' at 836 by pressing any navigation button. At 838, the user may choose to obtain more information if necessary. If the information is not adequate, at 840 the user may edit travel origination and destination information. If the information is adequate, the user is returned to 800 where he or she may select another database function.

If the user does not wish to display the results, at 842, the user may choose whether he or she wishes to continue accessing the database. If so, the user is returned to 814. If the user does not wish to continue, at 844, device 70'' is turned off.

If the user does not wish to access the database, at 846 the user may choose whether to use the voice recorder. If so, at 848 the user may use the voice recorder to enter voice data as previously described herein. If not, at 850 the user may choose whether to update the database. If the user chooses to update the database, at 852, the user inserts the OAG database memory card into one of memory slots 74'' or 76'', if not already inserted therein. At 854, the user inserts one end of phone line 105 into device 70'' and the other end into phone jack 101. Once a memory card is inserted and the phone line is properly connected, the user may update the database at 856 by selecting database update button 99. At 854, any additions, deletions and changes to the OAG database are automatically implemented via access to the host computer containing such updated information. In addition, any billing for accessing the host is preferably automatically billed to the user. With such a configuration, an automated updating process is obtained.

An embodiment of the invention especially suited for use on phones for storing critical messages is disclosed in FIGs. 10 and 11. As seen therein, a credit card size message storage and playback device 120 is provided with a pair of suction cups 122 and edge-located record and play buttons 124 and 126, respectively and an on/off button 128. A speaker 130 and a microphone 132 are provided and a normal selection of control keys 134. One suction cup is located immediately above the microphone 132 and has an opening in it to permit sound pick-up from the back surface of phone 115. It can be appreciated that device 120 could be any of the record and/or playback devices described herein.

Still another alternative embodiment of the present invention is shown in FIGs. 12 and 13. This embodiment may be considered an austere version of the embodiment

of FIGs. 1 through 4, with a special modification for use in on-site marketing of products. Thus, the configuration of the invention shown in FIG. 12 is an entirely self-contained unit having battery power, as well as a speaker and play button, playing a recorded analog audio message stored therein. However, while the embodiment of the invention shown in FIG. 12 has provision for storing messages, it is purposely devoid of any record button, so that messages stored therein cannot be erased, but only played. Recording of message therein can be accomplished by connecting the card to a separate console, similar to the console of FIG. 9, wherein a microphone and record control permit entering a message to be stored in the card. Thus, the card 100 of FIG. 12, provides only a play button 102 and a speaker 104, and as seen in FIG. 13, is designed to be installed on a shelf beneath a corresponding product. Thus for example, in FIG. 13, it is seen that each card 100 is installed below a respective product, such as products 110, 112 and 114, respectively.

It will be apparent that the purpose of the embodiment of the present invention shown in FIGs. 12 and 13 is to provide a prospective purchaser of a product in a retail store, such as supermarket or the like, with the opportunity to hear a message of short duration (up to approximately two minutes in duration, if desired), simply by pressing the play button on the card that is installed adjacent the product of interest. Each card 100 is preferably provided with an adhesive backing, so that it may be readily installed on a shelf in the manner shown in FIG. 13. It will be understood that because of the relatively low cost of the present invention, it is economically feasible to provide such a card for virtually every product in a large retail store, such as a supermarket, so that the user may gain additional information at the time of purchase for selecting a particular product in a message of up to at

least two minutes in duration. Such message may for example, describe the content of the product, its nutritional value, instructions on how to prepare the product, the relative advantages of the product over the competition's products of a similar nature, and other such information which may be instructional to the buyer or advantageous to the seller, whereby to convince a prospective purchaser to buy one product over another. Such play only embodiments may be used to provide audio instructions in a product package or serve as a business card an the like or as a toy, medical alert device or identification device for pets or personnel. It can be appreciated that card 100 could be replaced by any of the record and/or playback devices described herein.

Fig. 21 shows an interactive learning device. This device provides a user interface having a plurality of slots 1000 into which visual images 1001 may be inserted. This device is turned on and off via ON/OFF switch 1007. The user may scroll through visual images 1001 by pressing the select button 1004. Preferably, an LED 1002 is associated with each visual image 1001 and is configured to light up when its respective slot has been selected via select button 1004. The user may record a message for a selected visual image 1001 by selecting the record button 1006. The user can play a previously recorded through a speaker 10005 message by selecting the play button 1008. The device may also include a record protect button 1010 which, when selected, prevents the accidental recording over of existing messages. In a preferred form, the learning device is about 7 by 10 inches, and permits message durations of about 10 seconds. However, it can be appreciated that a smaller, portable travel learning device may also be provided.

For example, a parent can record descriptions or spellings for visual images 1001 inserted in slots 1000. Children can repetitively play these recordings to

become knowledgeable of the items represented by the visual images. Once the child has mastered these visual images, the parent can insert new visual images and record new messages for those visual images. Such a device has several advantages. First, the user interface can be customized to meet the needs of the user. For example, a third grader would require more advanced visual images than a first grader. Second, since the user interface is removable, the device never becomes "out of date."

FIG. 22 shows a watch recorder 1020. Watch recorder 1020 includes a record button 1022 for recording messages and a play button 1024 for playing back recorded messages. Messages can be of variable length, and the user can scroll through the messages by repetitively pressing play button 1024. A piezoelectric acoustic generator is preferably used for both microphone and speaker functions so as to keep the size of the watch small.

FIG. 23 shows a watch/identification device 1030. Unlike watch recorder 1020, watch identification device 1030 does not include a record button. Rather, it includes a play button 1024' and a slot (not shown) for receiving a non-volatile removable memory card 1034. Memory card 1034 is preferably a miniature version of the memory cards previously described herein so as to keep the size of watch identification device 1030 small. When memory card 1034 is inserted in watch identification device 1030, and upon selecting play button 1024', the messages contained within memory card 1034 will play. For example, one could record vital medical information onto the memory card, so that, in the event of an accident, a paramedic would be able to obtain such information instantaneously. While watch identification device 1030 has been shown without a record button, it can be appreciated that it could be provided with a record button. Likewise, watch recorder

1020 could also be provided with slots for receiving removable memory cards.

FIG. 24 shows yet another alternative embodiment of the present invention. As is shown in FIG. 24, like the previous embodiments, the record and playback device 1040 includes a speaker 1042, a microphone 1044, a plurality of LEDs 1046 and 1048, a play button 1050, a record button 1052, an erase button 1054, an erase all button 1056, and scroll buttons 1058 and 1060. In addition to these features, device 1040 also includes an insert button 1062 and a pause button 1064 that provide the unique and new editing features. A slide-on cover 1057 and a mailer 1058 as shown in FIGs. 25a and 25b may also be provided for transporting device 1040 between users.

A logic flow diagram for the editing operations performed by device 1040 is shown in FIG. 26. At 1066, the user has the option to record a message. The user may start recording a message by pressing record button 1052 at 1068, and can stop recording at 1070 by pressing record button 1052 again. At 1072, the user may decide whether he or she wishes to continue performing functions. If the user wishes to continue, at 1074, the program automatically tags the recorded message and automatically updates the table. If the user does not wish to continue, at 1076 the program also automatically tags the recorded message and automatically updates the table, and at 1078 turns device 1040 off.

At 1080, the user may decide whether he or she wishes to play a message. If so, at 1082 the user may choose whether to play the message at the current location. The user can play the message at the current location at 1084 by pressing play button 1050. At 1086, the user has the option whether or not to listen to the message. If the user wishes to listen to the message until completion, at 1088 the entire message is played. If the user does not wish to listen to the entire

message and at 1090 presses play button 1050 before the message is done, at 1092 the user has the option to edit the message. The user may also edit the message by pressing pause button 1064 at 1094 before the message is done.

If the user does not wish to edit the message, the program determines whether device 1040 is in the pause mode. If it is not, at 1120 the user has the option to select a desired location. If the user is at the desired location, the user is returned to 1072 where he or she may decide whether or not to continue recording. The user can select a desired location at 1122 by pressing scroll buttons 1058 and 1060. Preferably, one of LEDS 1046 or 1048 will flash as the user scrolls through each segment. If device 1040 is in the pause mode, the user can exit the pause mode, by pressing pause button 1064 at 1124.

If the user wishes to edit the message, at 1096 the user has the option to erase only a segment of the total recording. The user may erase a segment of the message at 1098 by pressing erase button 1054 and holding it down for a pre-selected period of time, such as one (1) second, upon which at 1200 the last segment listened to is erased. At 1102, the program automatically updates the tags to exclude the erased segment so that space becomes free for new recordings. At 1104, the user has the option to continue. If the user wishes to continue recording, he or she is returned to 1068. If the user does not wish to continue recording, the user is returned to 1076 as previously discussed herein.

If the user does not wish to erase a segment of the message, the user has the option to either insert information at 1106 or erase a fragment of information at 1108. A fragment is a contiguous collection of sectors which may span across message boundary, whereas a segment is a category group of sectors defined by the beginning and of the message. If the user wishes to

insert information, he or she is returned to 1068 to begin recording. The user may erase a fragment by pressing erase button 1054. Preferably, at 1112, the user must listen to the information selected to be erased to confirm that the fragment is in fact the one he or she wishes to erase. At 1114, the user is given the opportunity to change his or her mind. If the user does not change his or her mind, at 1116 the fragment can be erased by pressing erase button 1054 when the end of the fragment to be erased is reached. At 1126, the program automatically updates the tags to exclude the erased fragment so as to free up that space for new recordings. The user is then returned to 1104 where he or she may decide whether or not to continue recording. If the user changes his or her mind, he or she is returned to 1124.

FIG. 27a shows a further embodiment of device 1040 of FIG. 24. The device 1040' includes all of the features of device 1040 of FIG. 25, as well as at least one slot 1130 for receiving a removable memory card 1132. With such a configuration, only the memory card, rather than the entire device 1040' needs to be sent to the recipient. In this case, the mailer may be thinner and therefore less expensive. FIG. 27b shows a preferred mailer 1058' which is smaller than the mailer 1058 of FIG. 25b to accommodate one or more memory cards 1132.

FIG. 28 shows a base station 1200 for playing back messages stored on a playback and record device 1204, such as those previously described herein, when device 1204 is inserted into the slot 1202 of base station 1200. Base station includes a speaker 1214, preferably in the form of a voice coil with a diameter of one (1) inch or greater, and a volume control 1216 for adjusting the volume of speaker 1214. Base station 1200 may also include an LCD display 1218 for displaying information to the user, such as the time and date. Base station

1200 preferably runs off of standard AAA batteries 1220.

Base station 1200 also includes two contacts 1206 and 1208, for contacting corresponding contacts 1210 and 1212, respectively, on device 1204 so that base station bypasses the speaker and power source of device 1204 when device 1204 is inserted into base station 1200. In this manner, base station 1200 replaces and enhances the sound and power capabilities of device 1204. All of the other functions, however, are operated on device 1204. With such a configuration, a bigger speaker with more power than device 1204 may be used, and the battery life of device 1204 may be extended.

FIG. 29 shows a multiple user message center 1230. Message center 1230 allows multiple users to leave messages from one another. Message center 1230 like some of the other record and playback devices previously described herein, includes a speaker 1232, a microphone 1234, an enter button 1236, a select button 1238, a message waiting button 1240, a plurality of LEDs 1242 and 1244, an erase button 1246, an erase all button 1248, a play button 1248, a record button 1250, and an LCD display 1252. Message center 1230 includes on-board memory as represented by 1254. On-board memory 1254 is preferably used to record messages to be left for all users. Message center 1230 also includes a plurality of slots 1256, 1258, 1260 for receiving a plurality of removable non-volatile memory cards like memory card 1262. Each slot preferably belongs to a unique user of message center 1230. Messages to be left for others can either be recorded via a record and playback device as previously described herein, or directly via message center 1230.

A message can be left for one or more users of message center 1230 by first recording the message, and then pressing select button 1238 to scroll through the various users and pressing enter button 1236 when the desired user is currently activated. Preferably, a

plurality of LEDs 1264 are provided, each LED corresponding to one of slots 1256, 1258 and 1260 so that the LED corresponding to the activated user flashes to indicate which one is currently activated. Multiple users can be selected by holding down message waiting button 1240 while pressing select button 1236.

Having thus described preferred embodiments of the present invention herein, it will now be understood that the invention herein comprises a credit card size record/playback apparatus which permits analog recording of audio information of up to at least two minutes in duration in a package configuration which is entirely self-contained, requiring no external power supply or other electronic devices with which to operate. In one preferred embodiment of the present invention, a credit card size configuration comprises a suitable microphone and speaker which are both integrated into the credit card size package for operation in record and playback modes, respectively. A preferred embodiment of the present invention further provides liquid crystal displays for indicating time of day, date, and message count. Manually depressible switches are provided for controlling the record and playback operations, as well as for searching for and identifying different message or message events contained in the recording, such as by scrolling either forward or backward through the stored messages, from message to message or within a particular message. The invention may also be configured so that a user can only playback a recorded message without recording over or erasing that message. Such a configuration may be readily implemented by providing only a play switch, recording or re-recording being accomplished only by connecting a suitable electric connector to the device and thereby recording a pre-selected message prior to public disbursement of the device. Such pre-recorded play only configurations may have significant advantageous applications in

conjunction with on-site advertising and marketing of products available in retail stores. Still another configuration of the present invention disclosed herein, comprises a voice card version which has no speaker or microphone or batteries associated therewith, and which is operated in conjunction with a separate console unit, which may be used to create and playback messages, as well as to copy from one card onto another for archival purposes.

Those having ordinary skill in the art to which the present invention pertains, will now as a result of the applicants' teaching herein, perceive various modifications and additions which may be made to the invention. By way of example, the particular shape, size and configuration of the invention may be readily altered to virtually any configuration which can house the requisite components thereof. Thus for example, the present invention may be configured in other forms where it can be used in a surreptitious manner if desired in a product configuration not normally recognizable as a record and playback device. Furthermore, the present invention may be configured for stacking a number of voice cards in an interconnected arrangement or cascading several record and playback circuit chips on one card whereby the total duration of recording is equal to the sum of the durations of the respective cards or chips, so that a record/playback apparatus having substantially greater message storage and playback capacity is implemented. Accordingly, all such modifications and additions are deemed to be within the scope of the invention, which is to be limited only by the claims appended hereto and their equivalents.

CLAIMS

1. An operator-actuated audio message storage and retrieval system, comprising:

a microphone for receiving a plurality of audio messages;

a speaker;

a solid-state audio signal processor coupled to the microphone;

a memory coupled to the audio signal processor and configured for storing the plurality of audio messages;

switch means for selectably producing a storage mode signal and a retrieval mode signal; and

a system controller for accessing a plurality of non-contiguous storage locations in the memory and for storing each of the plurality of audio messages in a corresponding one of the plurality of non-contiguous storage locations in response to the storage mode signal, and for consecutively retrieving selected audio messages from their corresponding storage locations in an order in which the selected audio messages were received by the microphone in response to the retrieval mode signal for outputting the selected audio messages to the speaker.

2. The system of Claim 1, wherein:

the memory comprises a message address table for storing each of a plurality of message address tags associated with a corresponding one of the plurality of stored audio messages;

the switch means comprises erase control means for producing an erase mode signal; and

the system controller, in response to the erase mode signal, deletes a memory address tag from the message address table corresponding to an undesired audio messages stored in the memory, thereby making available a memory location previously allocated for

storing the undesired audio message.

3. The system of Claim 1, further comprising a housing having dimensions of approximately 3.4 inches by approximately 2.1 inches by approximately 0.3 inches, the housing providing support for the microphone, the speaker, the audio signal processor, the memory, the system controller, and the switch means.

4. The system of Claim 1, wherein:

the switch means comprises means for selectably producing a forward retrieval mode signal and a reverse retrieval mode signal; and

the system controller, in response to the forward retrieval mode signal, effects retrieval of the selected audio messages from their corresponding storage locations on a last-in-last-out basis, and, in response to the reverse retrieval mode signal, effects retrieval of the selected audio messages from their corresponding storage locations on a last-in-first-out basis.

5. The system of Claim 1, further comprising a time of day clock, wherein the system controller, responsive to the time of day clock reaching a preselected time of day, retrieves an audio alarm message from the memory for outputting the audio alarm to the speaker.

6. The system of Claim 1, further comprising a display, coupled to the system controller, for displaying information associated with the plurality of audio messages stored in the memory.

7. The system of Claim 1, wherein the audio signal processor comprises an analog solid-state audio signal processor for processing the plurality of audio messages for storage in the memory in an analog format.

8. The system of Claim 1, wherein the audio signal processor comprises a digital solid-state audio signal processor for processing the plurality of audio messages for storage in the memory in a digital format.

9. An apparatus including the system of Claim 1, and further comprising:

a docking console comprising a console controller and a console connector configured to detachably engage a system connecter disposed on the detachable audio message storage and retrieval system, the console providing support for the microphone, the speaker, and the switch means; and

a display disposed on the console controller for displaying information associated with the detachable audio message storage and retrieval system;

wherein:

the switch means comprises means for selectably initiating communication between the console controller and the system controller of the detachable audio message storage and retrieval system and for selectably producing the storage mode signal and the retrieval mode signal; and

the console and system controllers cooperatively operate to store the plurality of audio messages to the accessed non-contiguous storage locations in response to the storage mode signal and to consecutively retrieve the selected audio messages from their corresponding storage locations in the order in which the selected audio messages were received by the microphone for outputting the selected audio messages to the speaker.

10. The apparatus of Claim 9, wherein:

the console includes a first console connector configured to detachably engage a first system connector disposed on a first detachable audio message storage and

retrieval system, and a second console connector configured to detachably engage a second system connector disposed on a second detachable audio message storage and retrieval system; and

the switch means comprises means for selectably initiating communication between the console controller and either one of a first system controller and a second system controller disposed in the first and second detachable audio message storage and retrieval systems, respectively.

11. The apparatus of Claim 10, wherein the switch means comprises means for selectably initiating a transfer of a first audio message stored in an addressable memory of the first detachable audio message storage and retrieval system to an addressable memory of the second detachable audio message storage and retrieval system.

12. The apparatus of Claim 10, wherein the switch means comprises a controllable switch coupled to the console controller, the controllable switch selectably coupling the first detachable audio message storage and retrieval system between the speaker and the second detachable audio message storage and retrieval system.

13. The system of Claim 1, further comprising:

a separate communications device; and

affixation means for affixing the audio message storage and retrieval system to the separate communications device;

wherein the microphone receives the plurality of audio messages from the separate communications device.

14. The system of Claim 13, wherein:

the affixation means includes at least one

suction cup including an aperture oriented proximate the microphone to enhance transmission of the plurality of audio messages between the separate communications device and the microphone of the audio message storage and retrieval system.

15. The system of Claim 1, further comprising:

a support structure coupled to the audio message storage and retrieval system; and

means for displaying indicia on the support structure;

wherein:

the memory is configured for storing at least one audio message associated with the indicia;

the switch means is disposed on the support proximate the indicia and is operative only in a retrieval mode for producing the retrieval mode signal; and

the system controller, in response to the retrieval mode signal, coordinates retrieval of the at least one audio message associated with the indicia for broadcasting over the speaker.

16. The system of Claim 1, comprising a plurality of audio signal processors coupled together in a cascade relationship, wherein the system controller produces power control signals to coordinate removal of power from an audio signal processor coupled to a saturated memory concurrently with application of power to an audio signal processor coupled to an unsaturated memory.

17. The system of Claim 1, further comprising:

at least one memory card connector configured to detachably receive and electrically communicate with a detachable memory card.

18. The system of Claim 1, further comprising at least one memory card connector configured to detachably receive and electrically communicate with a detachable memory card containing a database of information, wherein the switch means comprises either one of manual and voice command navigation control means for navigating through the database information.

19. The system of Claim 1, further comprising:

means for communicating with a remotely located host processor over a communication channel; and

at least one memory card connector configured to detachably receive and electrically communicate with a detachable memory card containing a database of information;

wherein the switch means comprises either one of manual and voice command update control means for initiating uploading of database information from the remotely located host processor to the memory card over the communication channel.

20. An apparatus including the system of Claim 1, and further comprising:

a housing coupled to the audio message storage and retrieval system;

a display apparatus disposed on the housing comprising a plurality of support slots for removably supporting a corresponding plurality of visual images; and

an illuminatable annunciator disposed on the housing proximate each of the plurality of support slots;

wherein the switch means is disposed on the housing and includes a select switch for selectably illuminating any of the plurality of illuminatable annunciators and for respectively storing and retrieving an audio message associated with a visual image

proximate a selected illuminated annunciator.

21. The apparatus of Claim 20, further comprising record mode disabling means for disabling the system controller from storing the plurality of audio messages in the memory.

22. An apparatus including the system of Claim 1, and further comprising:

a casing for housing a portable timekeeping device and for supporting the microphone, the speaker, and the switch means;

a clock device disposed in the casing; and

a time display supported by the casing and coupled to the clock device for visually communicating a clock time.

23. The apparatus of Claim 22, further comprising at least one memory card connector configured to detachably receive and electrically communicate with a detachable memory card.

24. An apparatus including the system of Claim 1, and further comprising:

a console for housing the audio message storage and retrieval system and for providing support for the microphone, the speaker, and the switch means; and

a display disposed on the console and coupled to the system controller for displaying information associated with the audio message storage and retrieval system;

wherein:

the memory is configured for storing a plurality of audio messages associated with a plurality of users;

the switch means comprises a user selection switch for selectably producing a user selection signal associated with a selected one of the plurality of users; and

the system controller, in response to the user selection signal and storage mode signal, stores a user-specific audio message at a storage location associated with the selected one of the plurality of users.

25. The apparatus of Claim 24, further comprising at least one memory card connector configured to detachably receive and electrically communicate with a detachable memory card.

26. A method for storing and retrieving audio messages in an operator-actuated audio message recording and playback system, comprising the steps of:

providing a solid-state audio signal processor coupled to a memory, the memory configured to store a plurality of received audio messages;

selectably producing a storage mode signal and a retrieval mode signal;

storing the plurality of received audio messages at random storage locations in the memory in response to the storage mode signal;

retrieving consecutively received audio messages of the plurality of received audio messages from the random storage locations in a corresponding consecutive order in response to the retrieval mode signal; and

broadcasting the retrieved consecutively received audio messages in the corresponding consecutive order.

27. The method of Claim 26, including the further step of:

selectably producing a forward retrieval mode signal and a reverse retrieval mode signal, wherein the retrieving step includes the further steps of:

retrieving the consecutively received audio messages from the random storage locations on a last-in-last-out basis in response to the forward retrieval mode signal; and

retrieving the consecutively received audio messages from the random storage locations on a last-in-first-out basis in response to the reverse retrieval mode signal.

28. The method of Claim 26, wherein the storing step includes the further step of storing newly received ones of the plurality of received audio messages to random storage locations in the memory without referencing the random storage locations of previously received ones of the plurality of received audio messages in the memory in response to the storage mode signal.

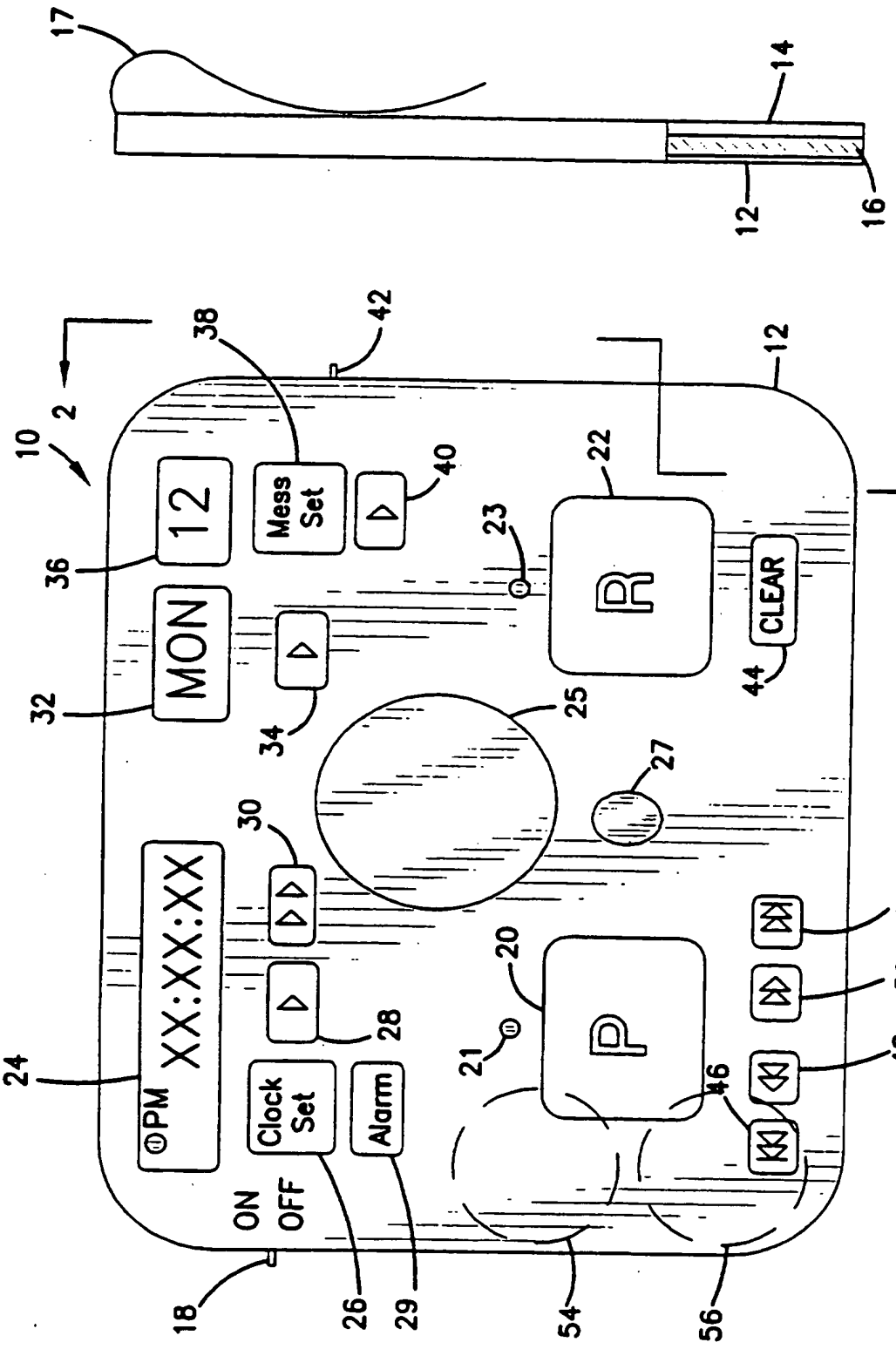

FIG. 1

FIG. 2

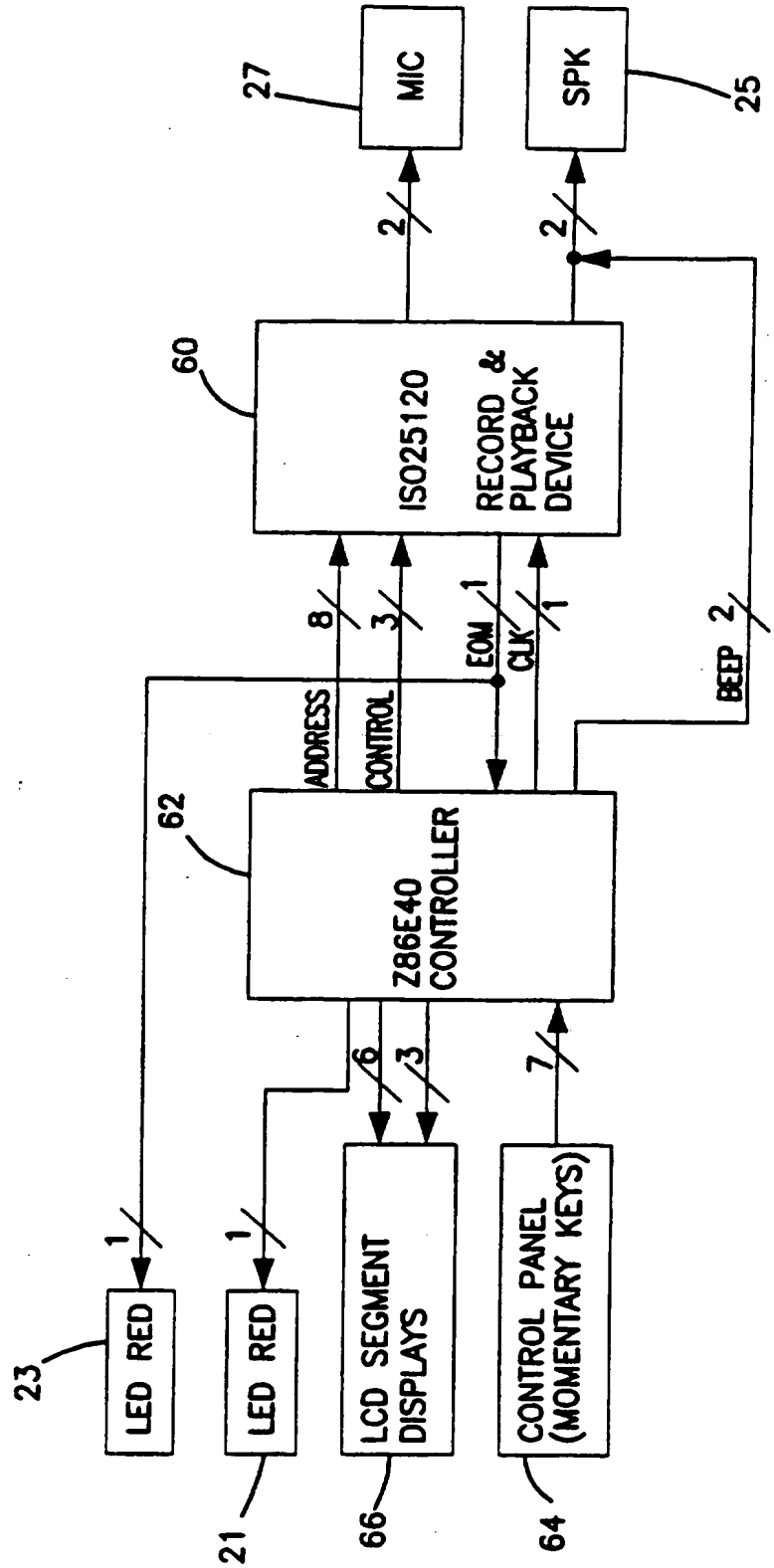

FIG. 3

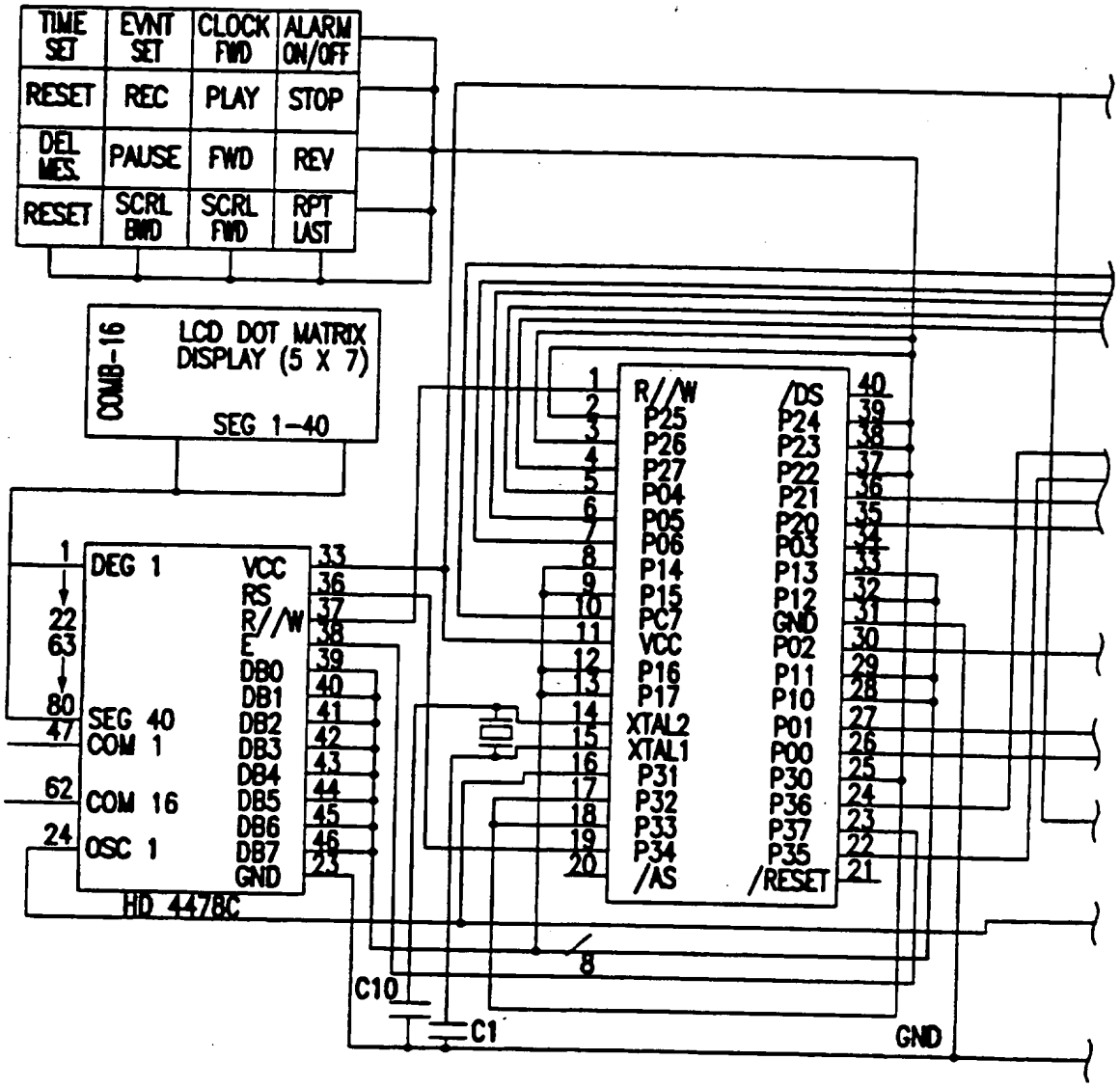

FIG. 4A

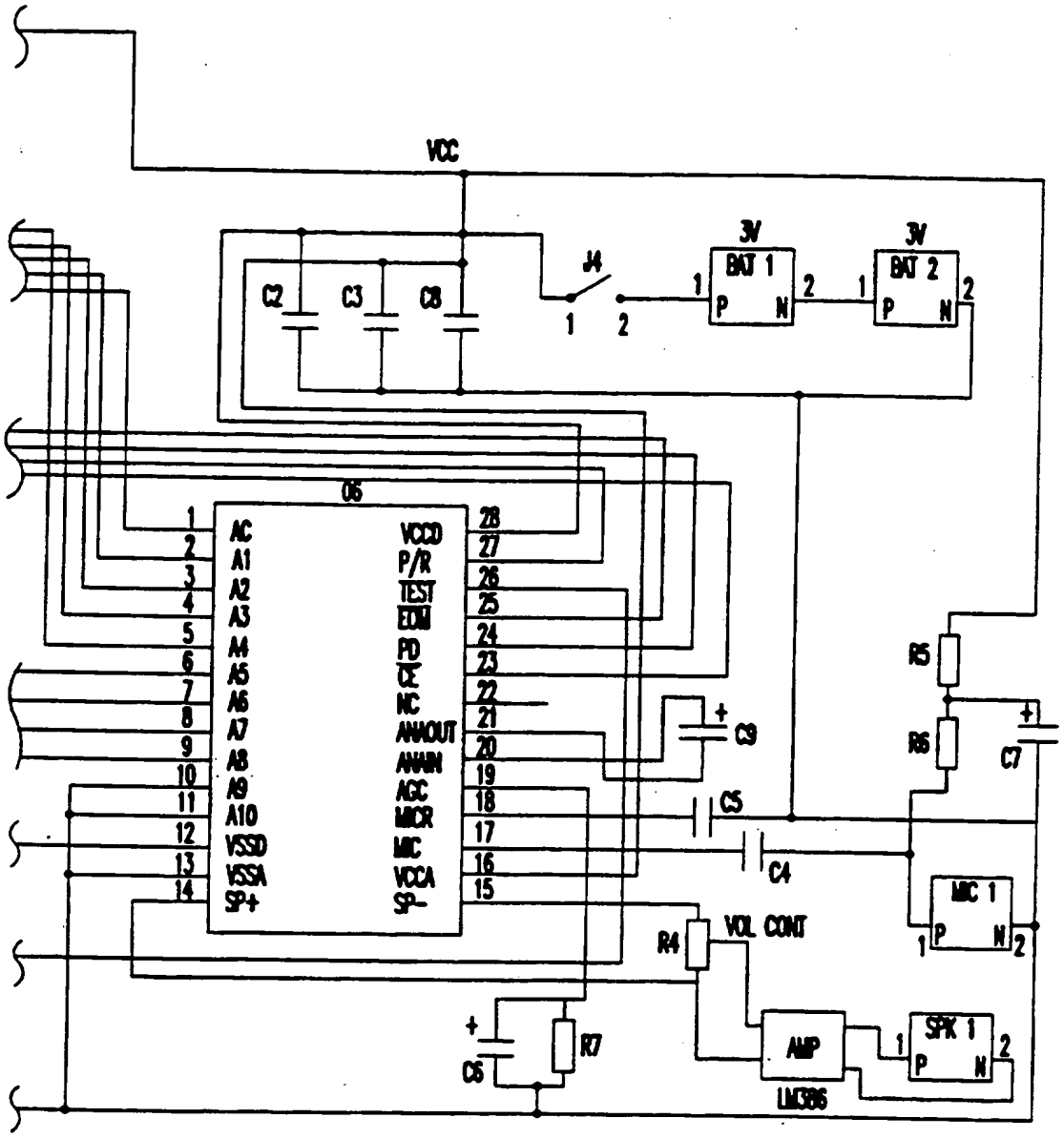

FIG. 4B

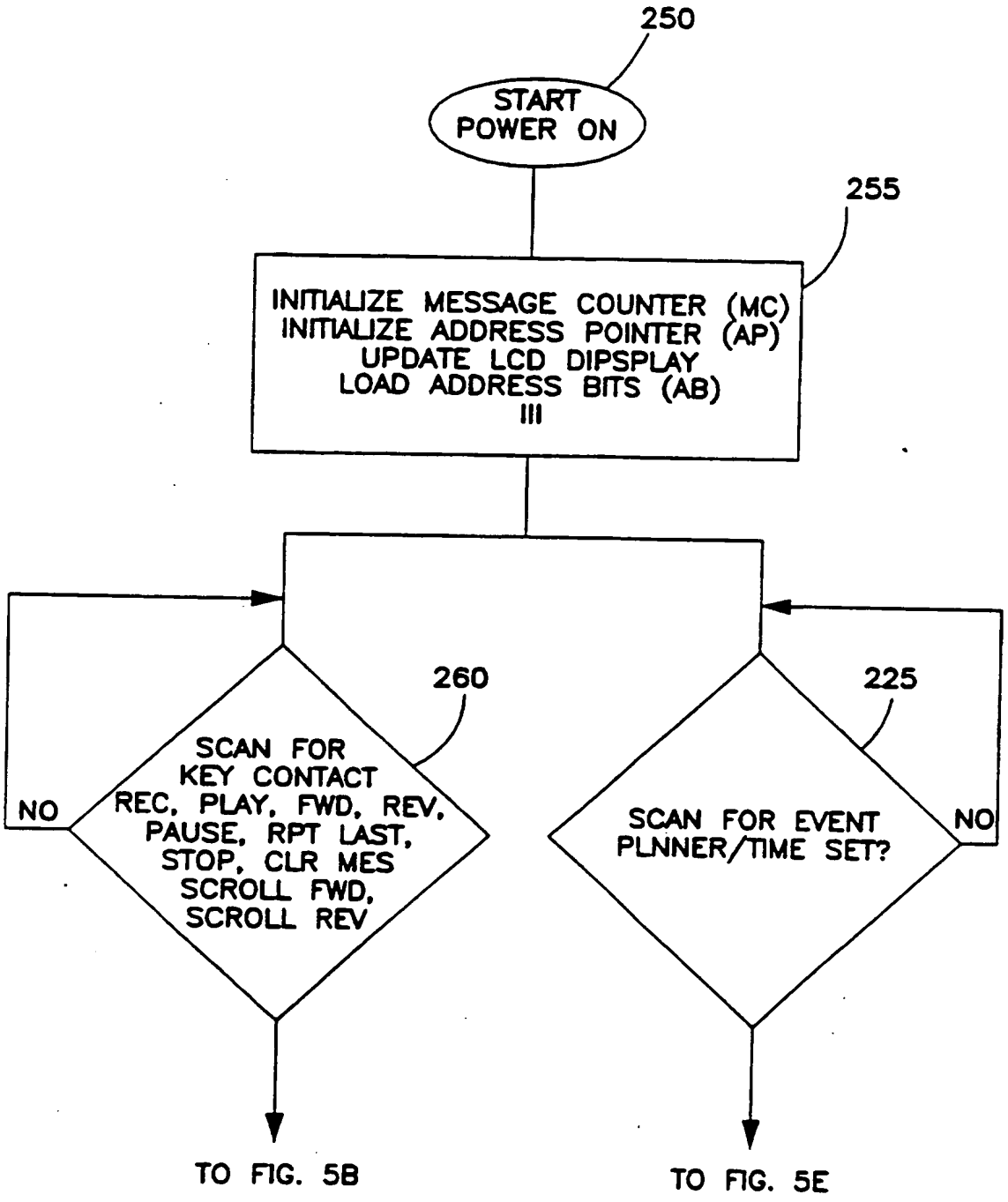

FIG. 5A

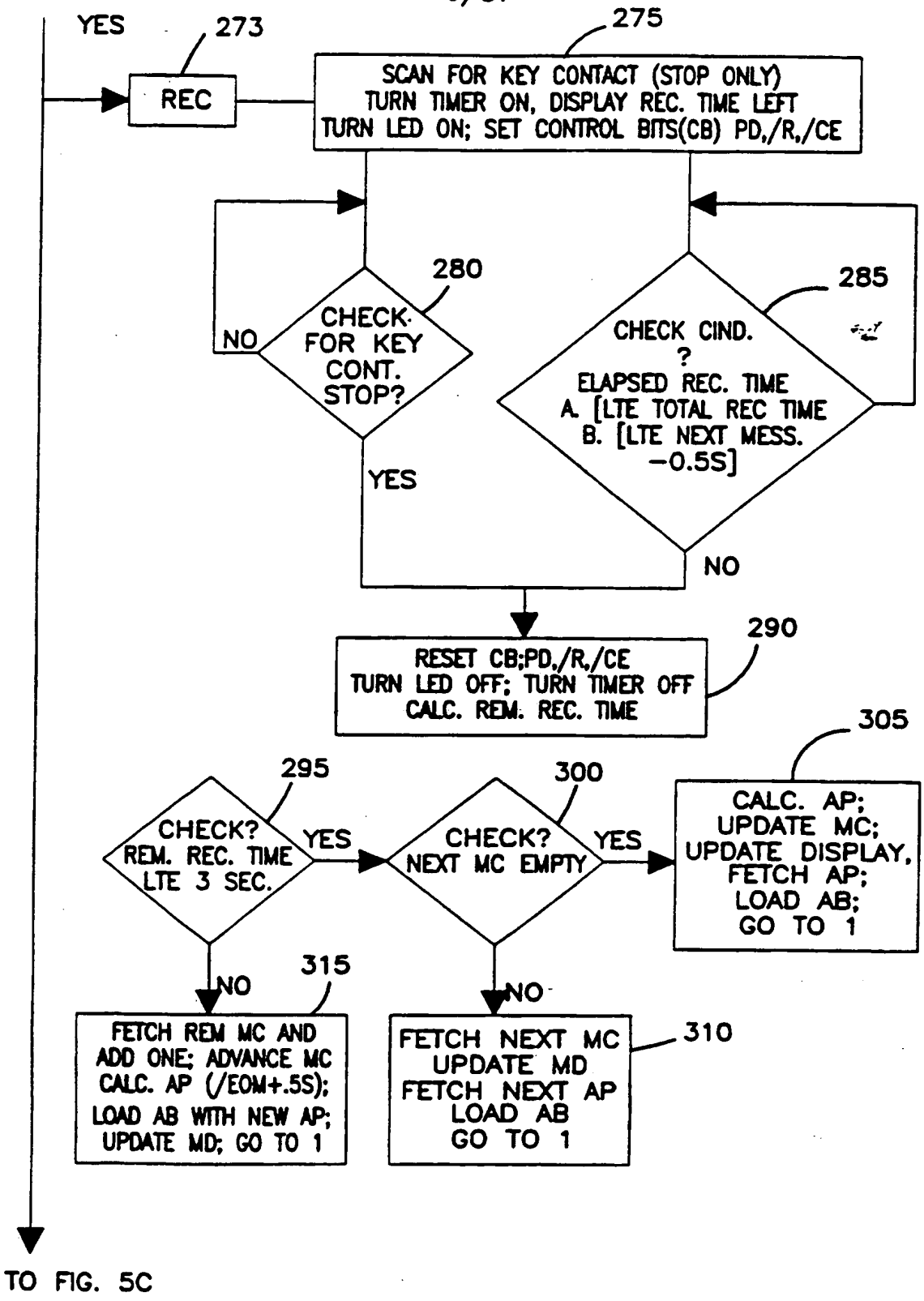

FIG. 5B

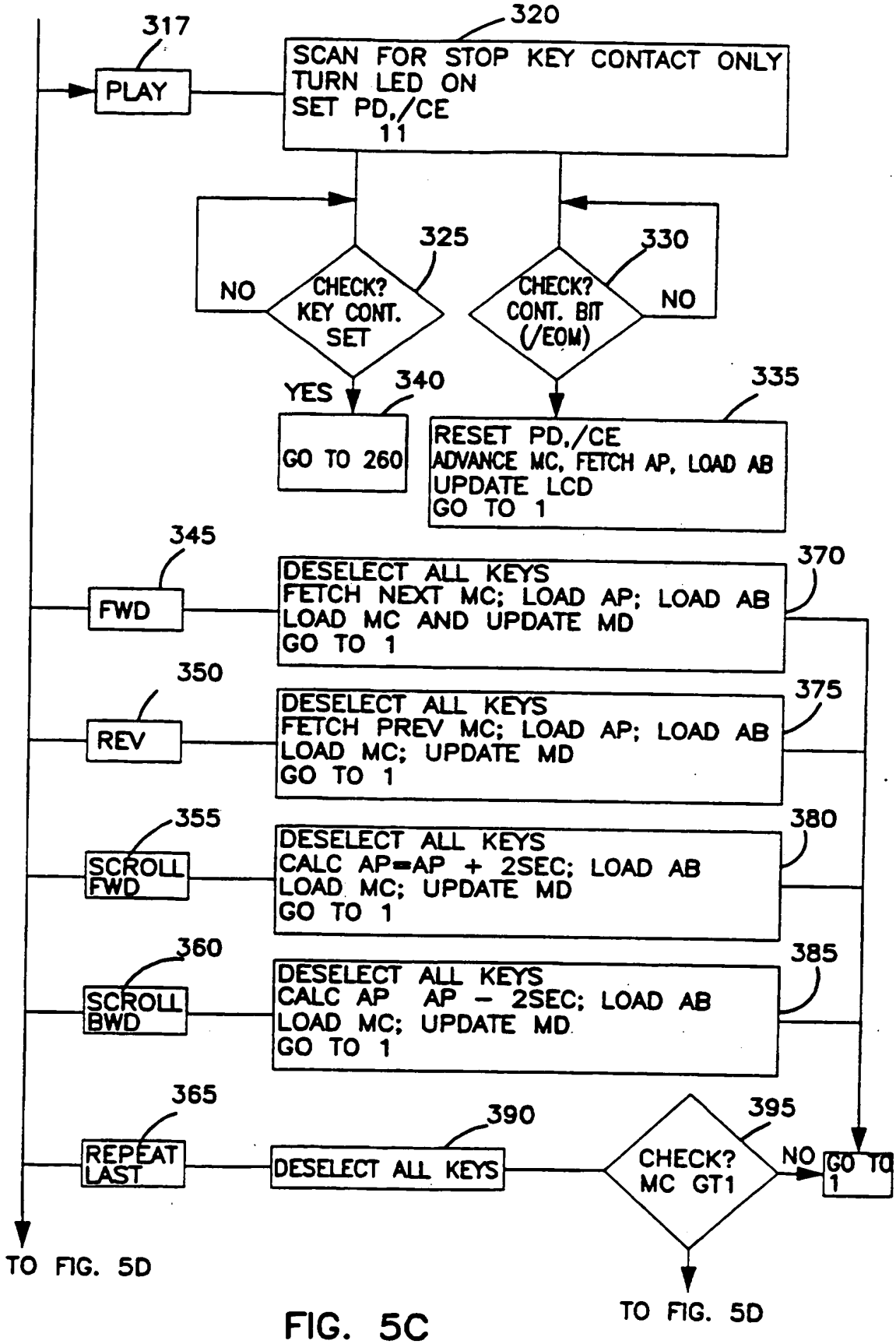

FIG. 5C

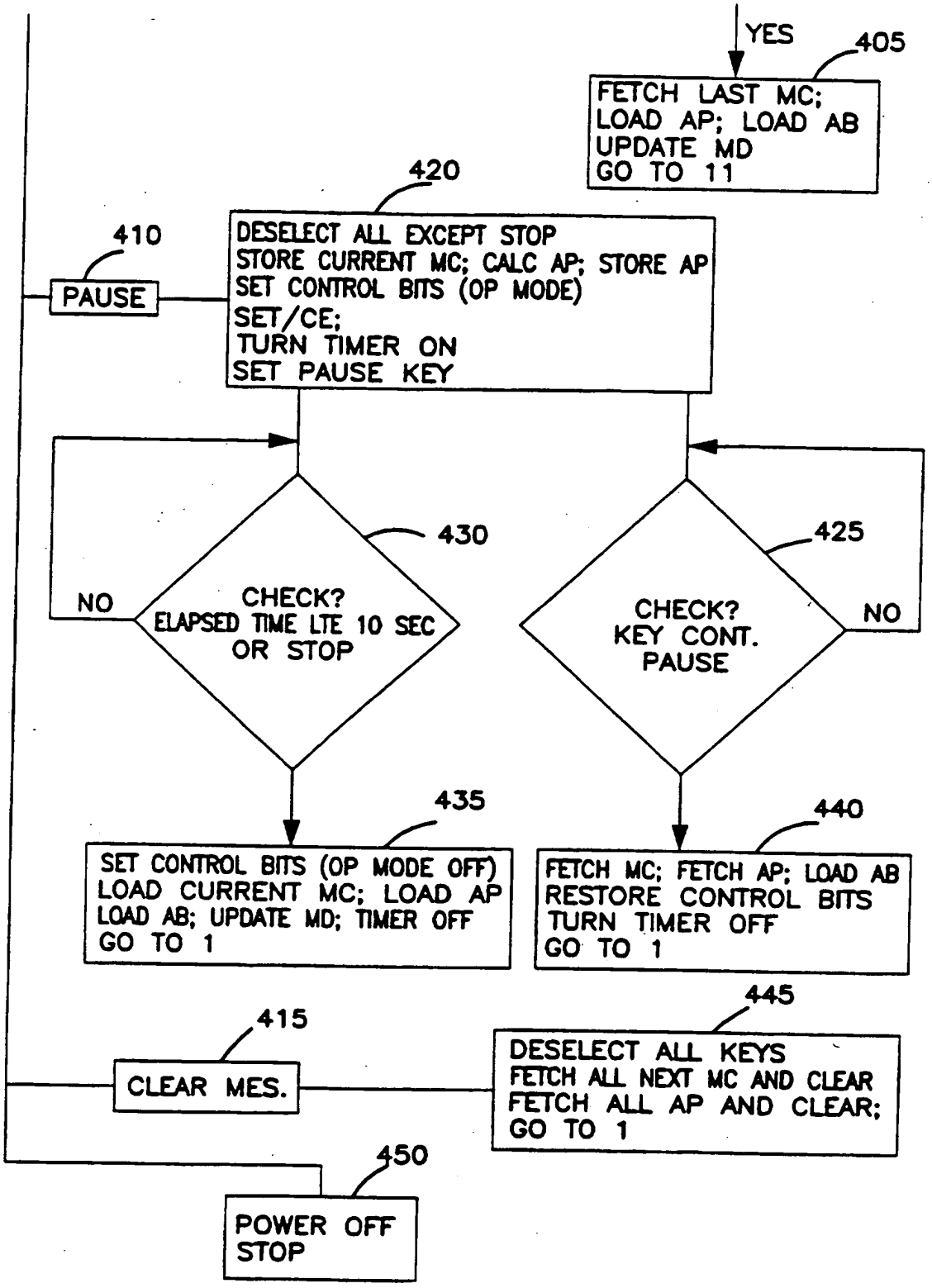

FIG. 5D

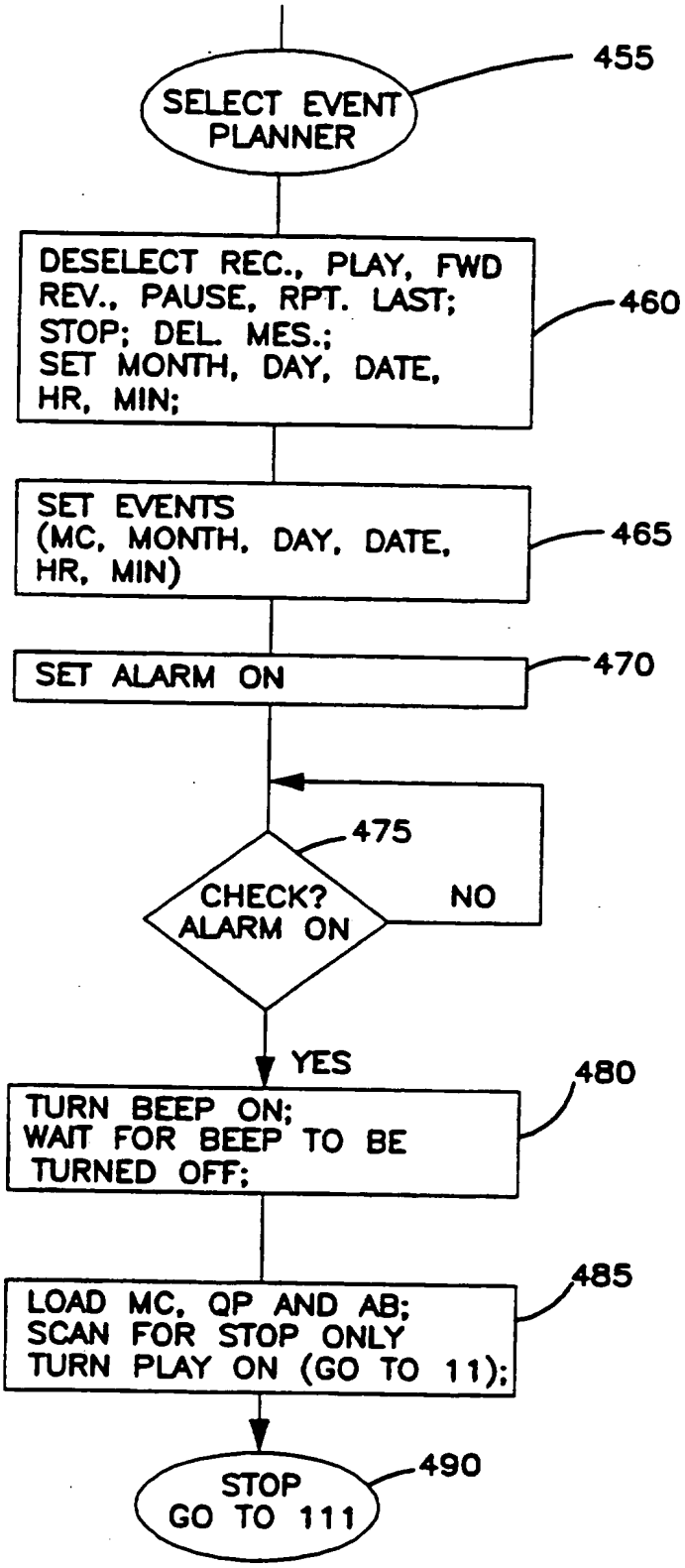

FIG. 5E

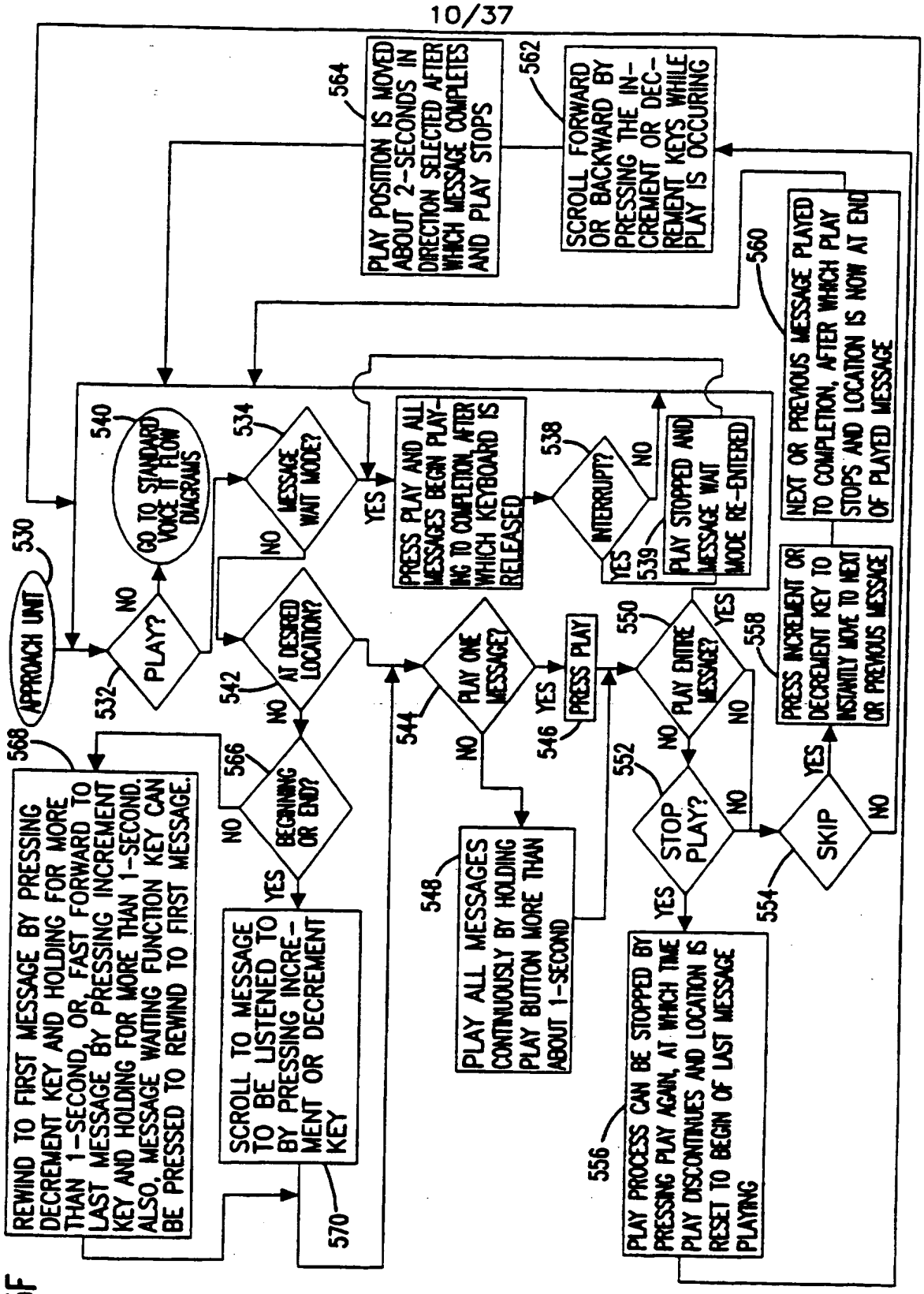

FIG. 5F

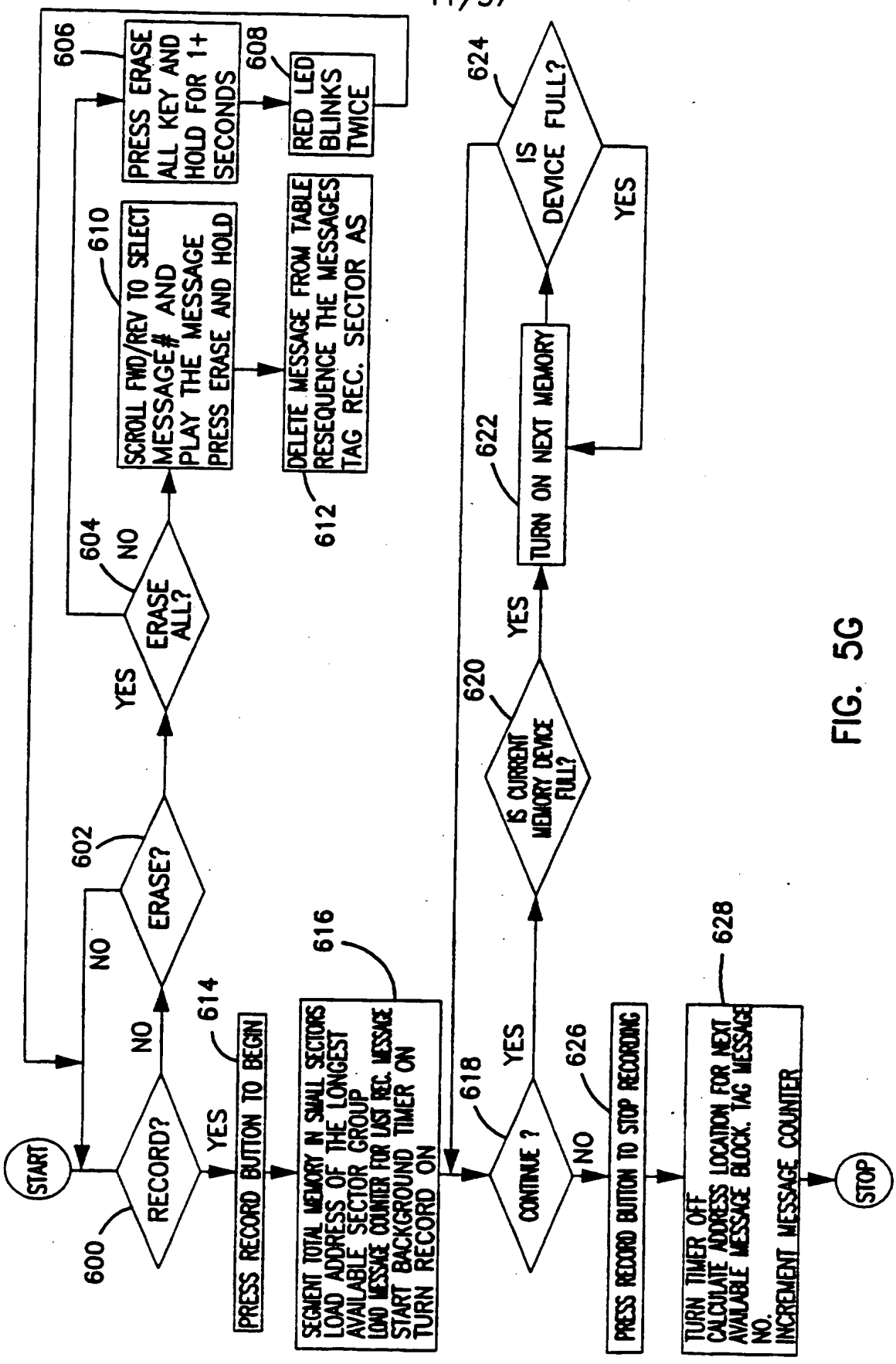

FIG. 5G

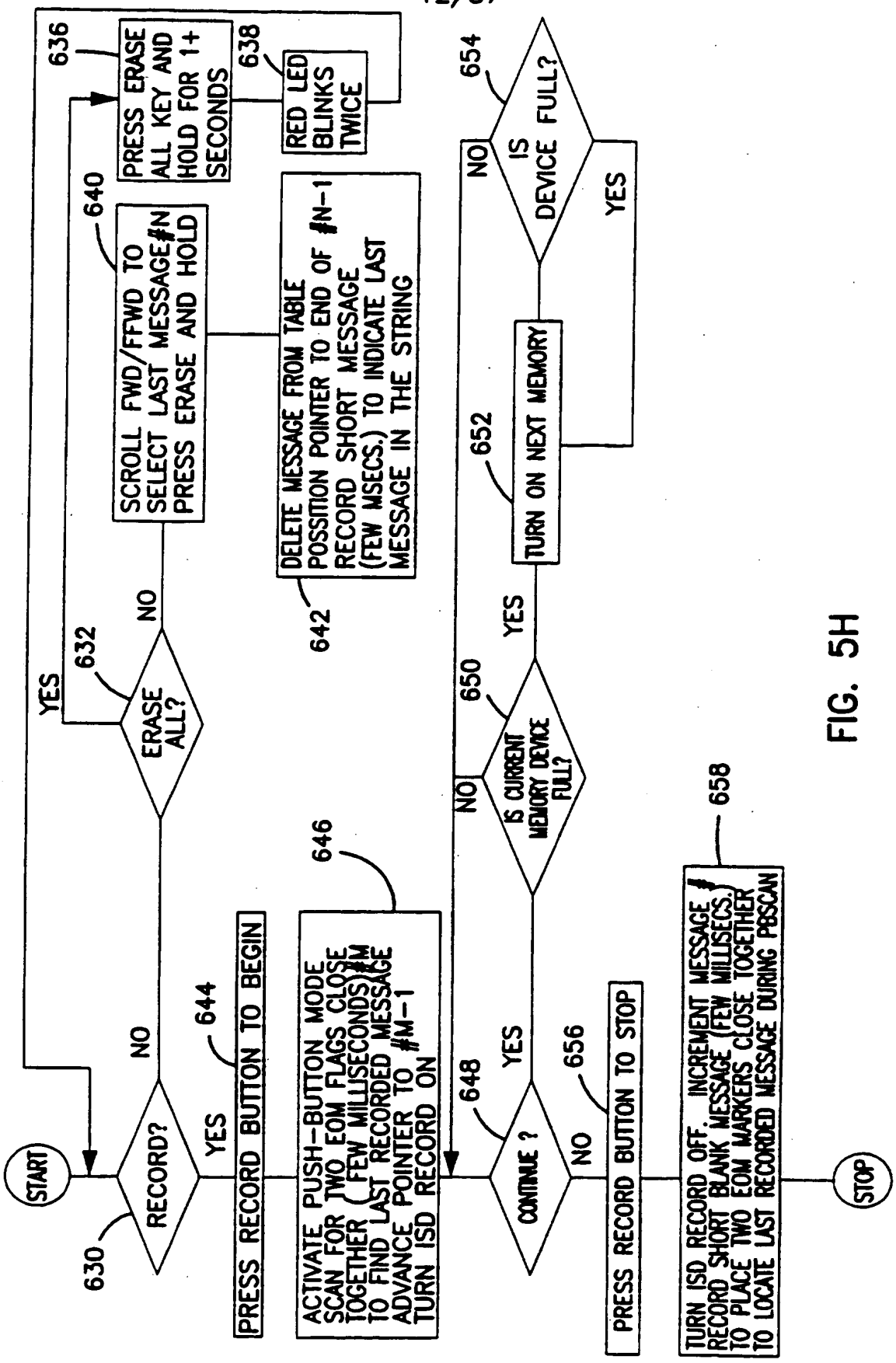

FIG. 5H

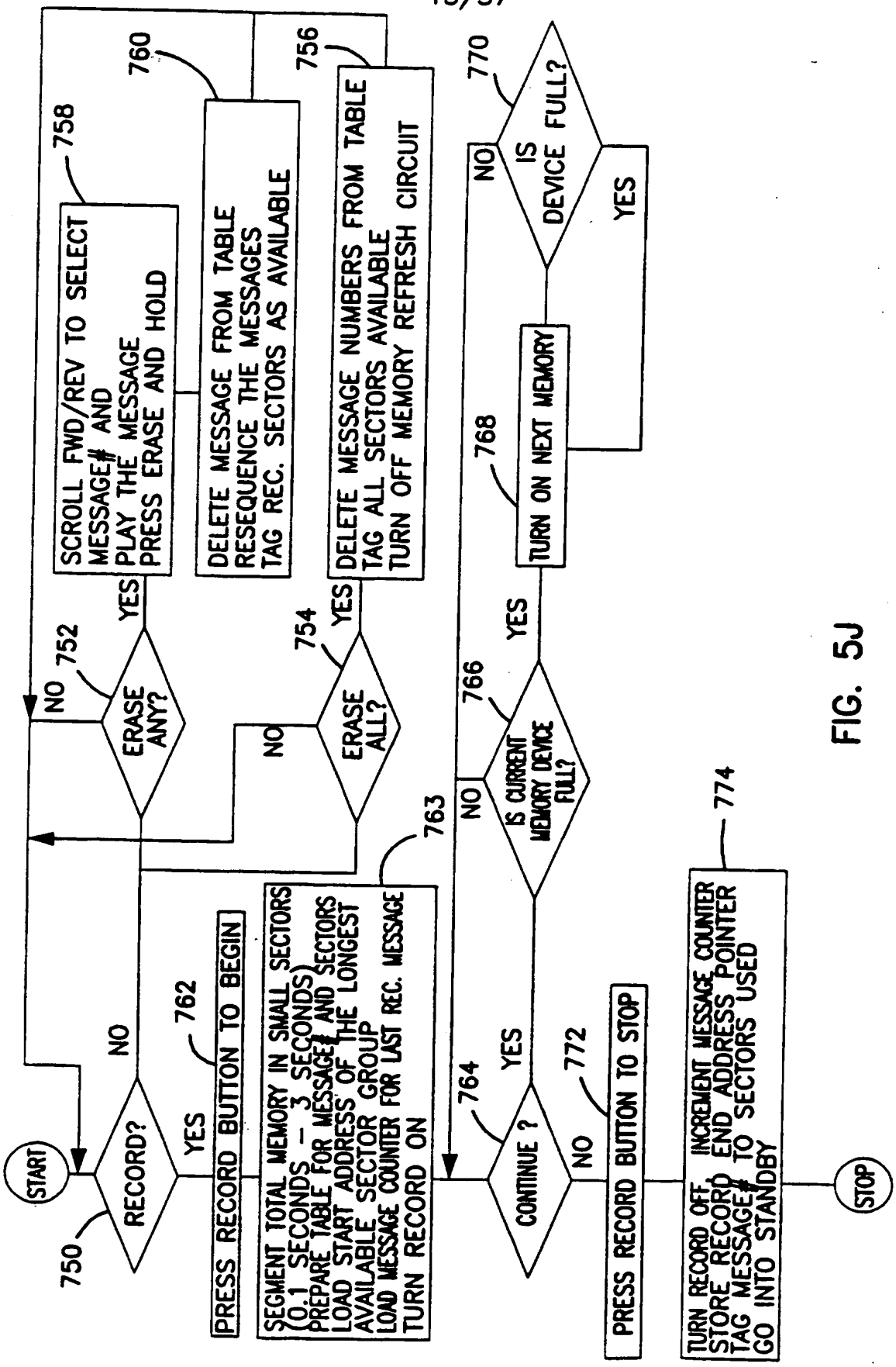

FIG. 5J

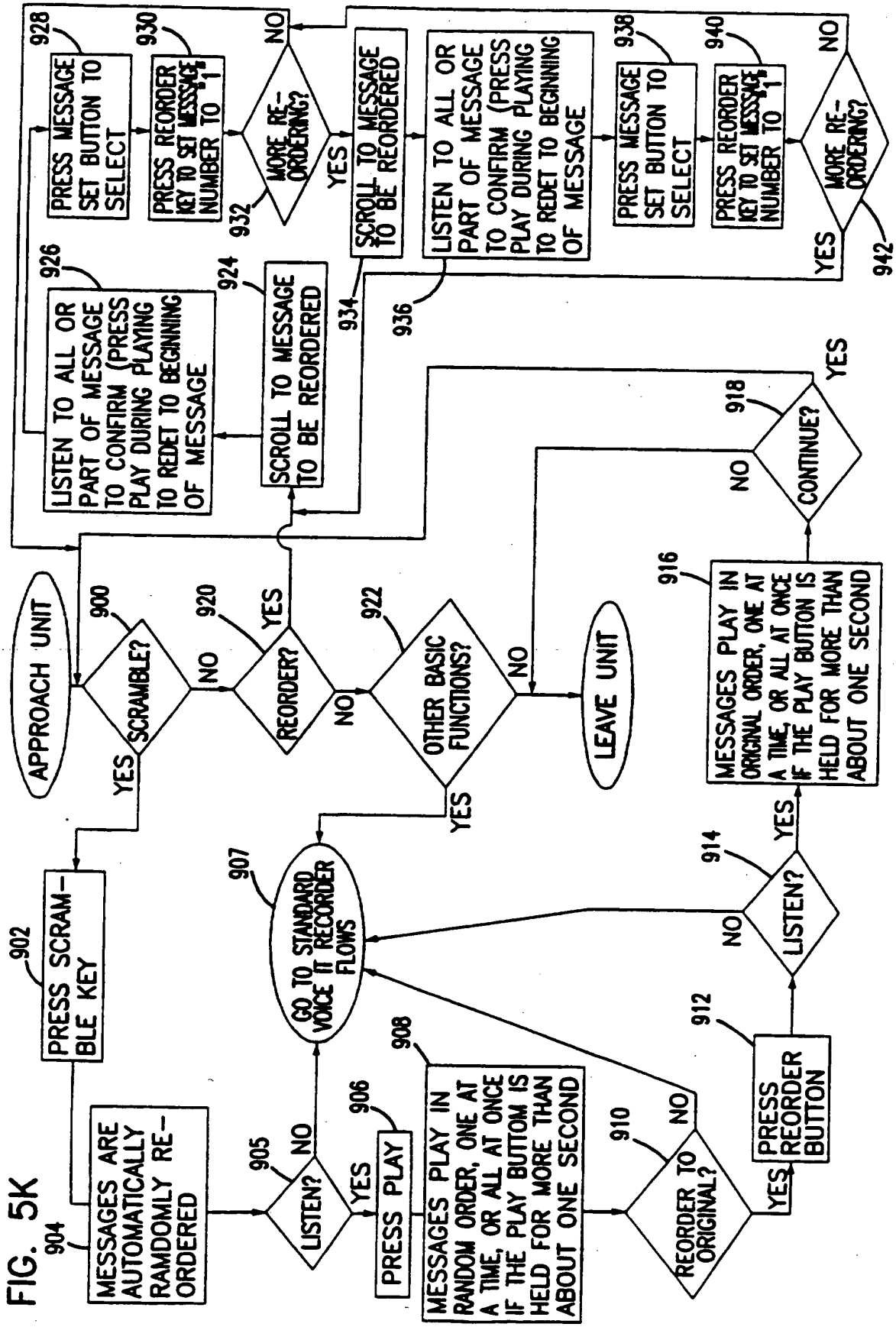

FIG. 5K

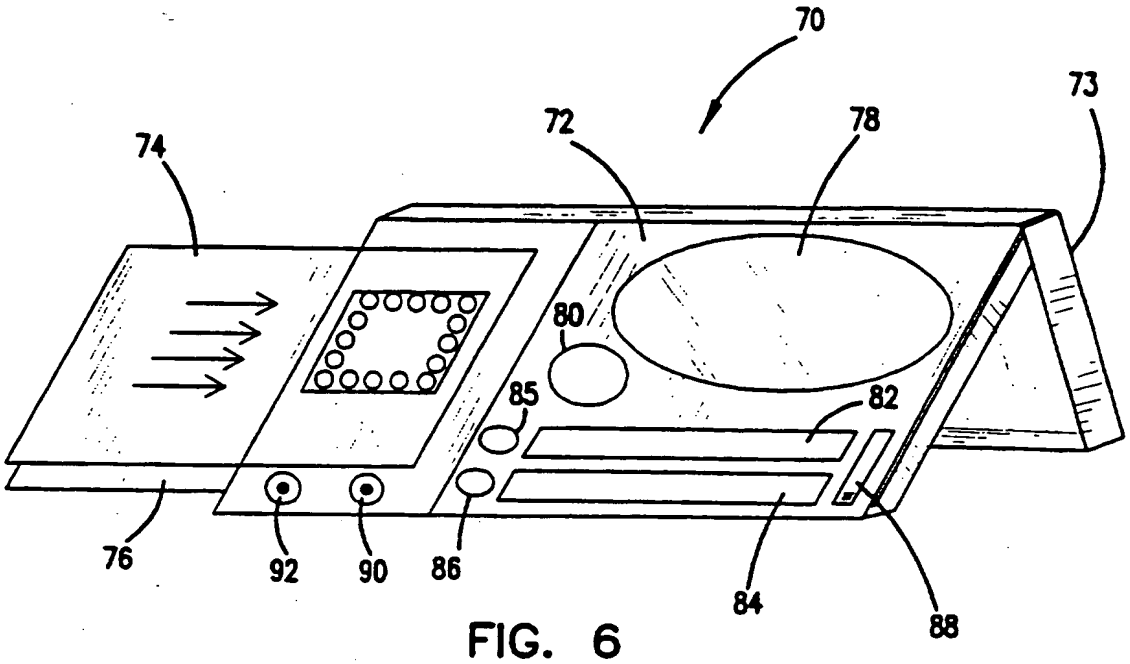

FIG. 6

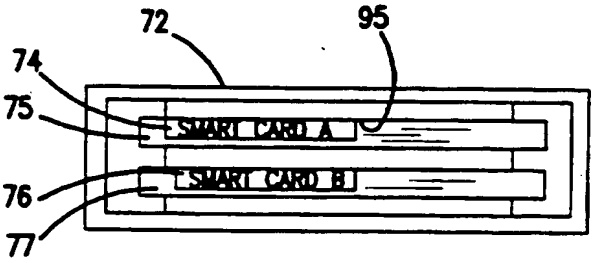

FIG. 7

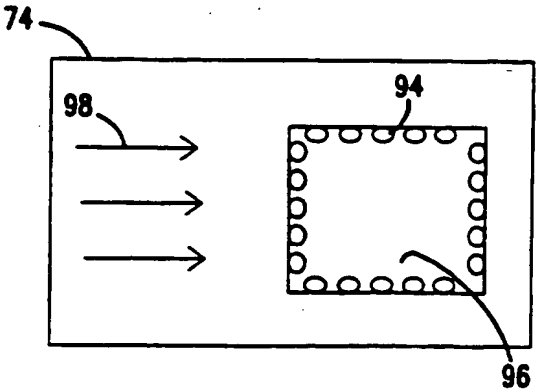

FIG. 8

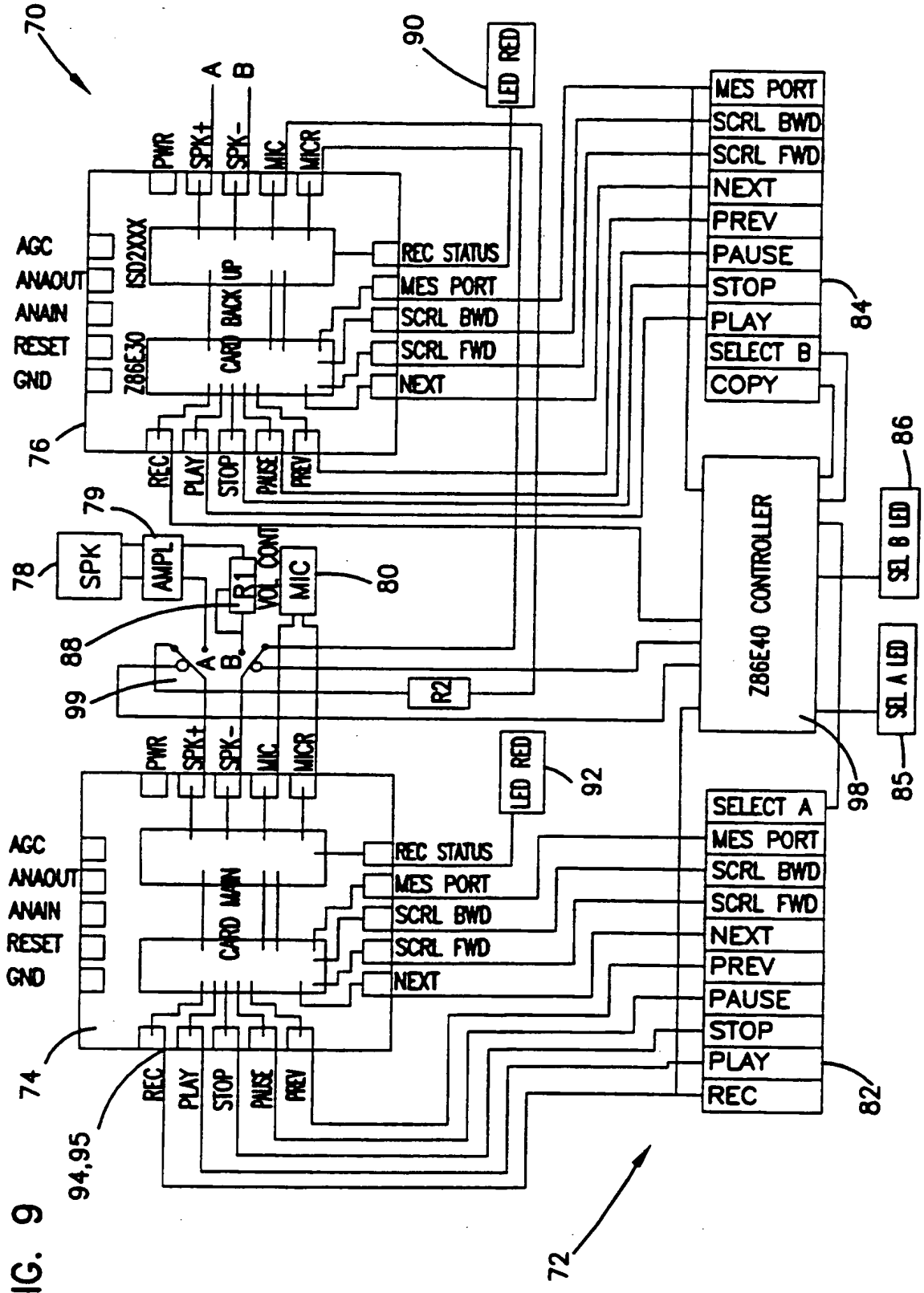

FIG. 9

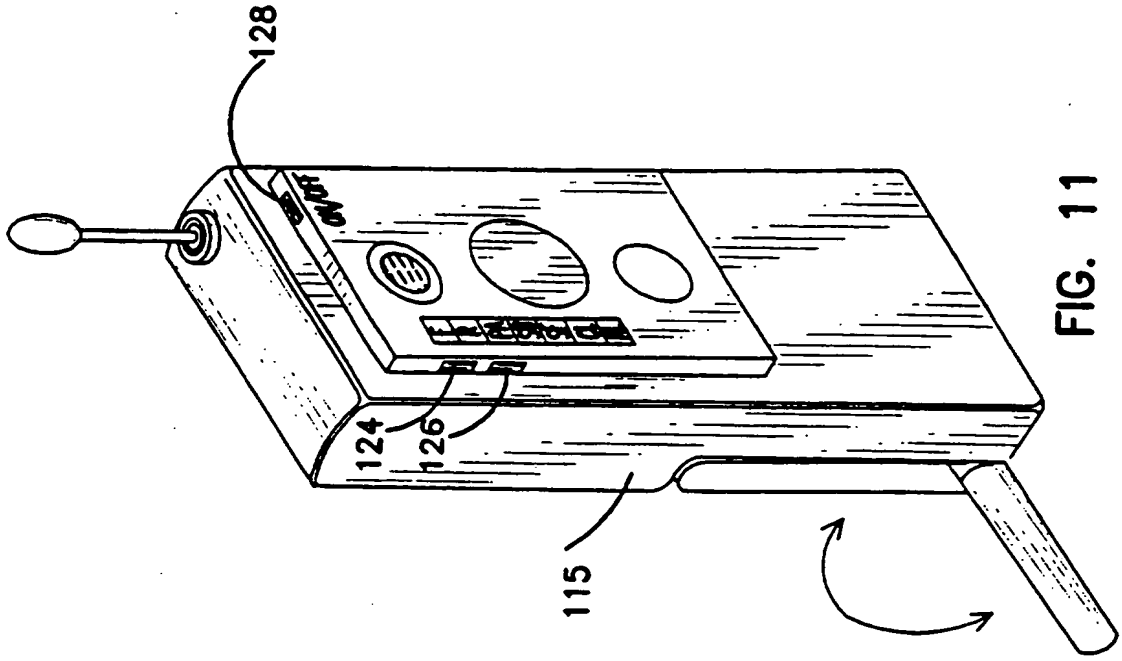

FIG. 11

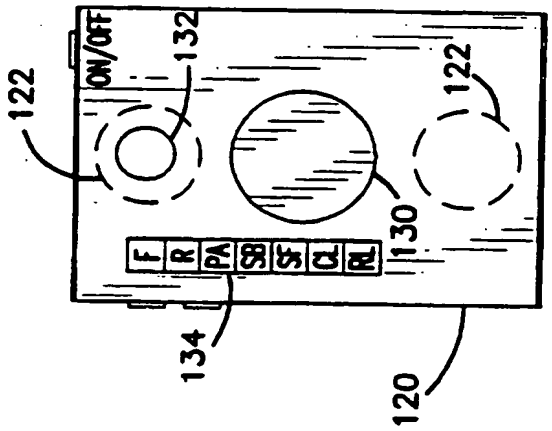

FIG. 10

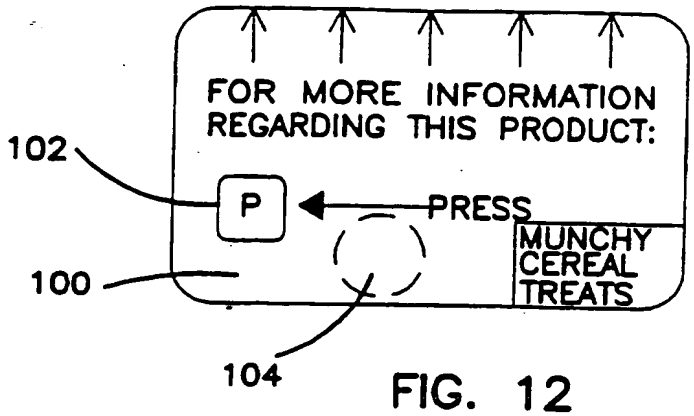
FOR MORE INFORMATION
REGARDING THIS PRODUCT:
102
P
PRESS
MUNCHY
CEREAL
TREATS
100
104

FIG. 12

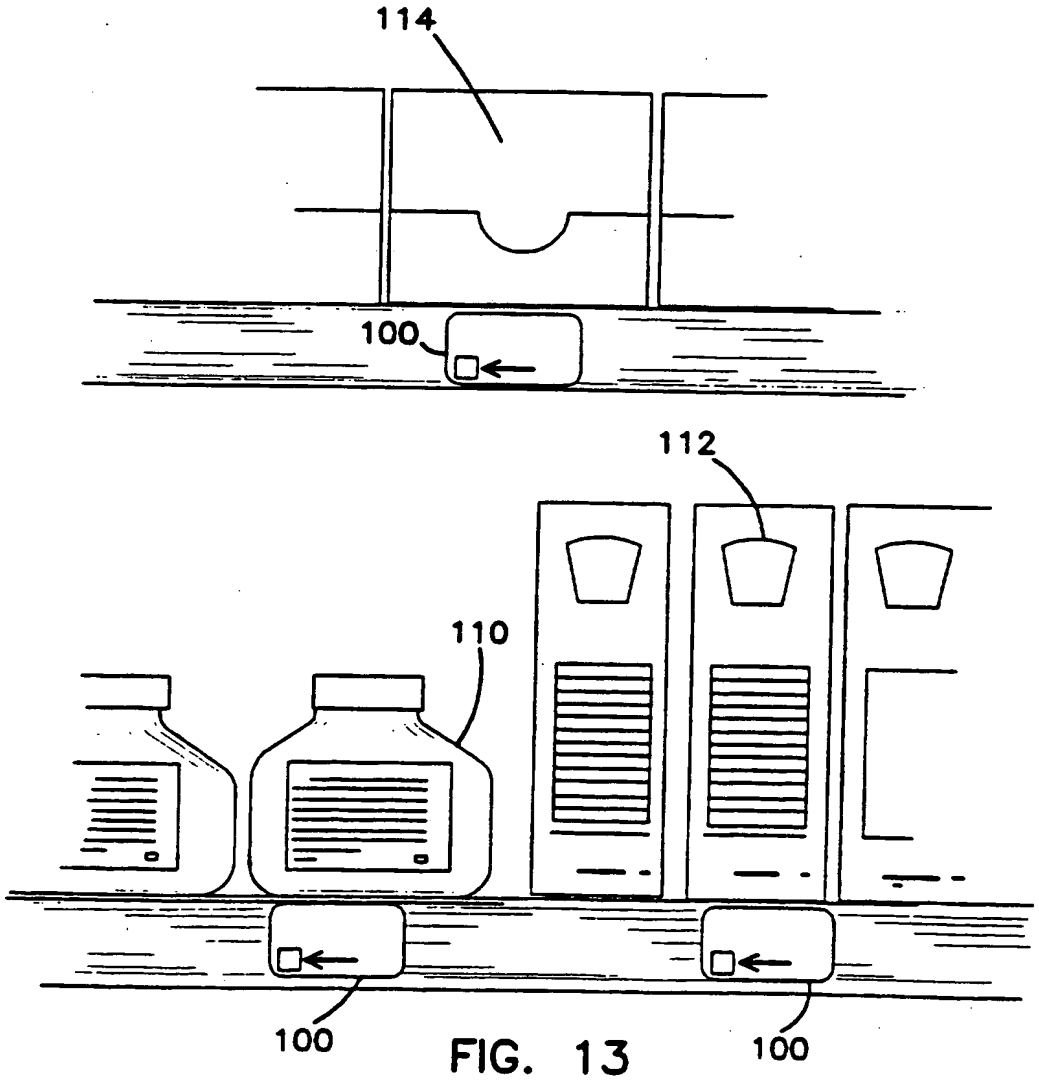
114
100
112
110
100
100

FIG. 13

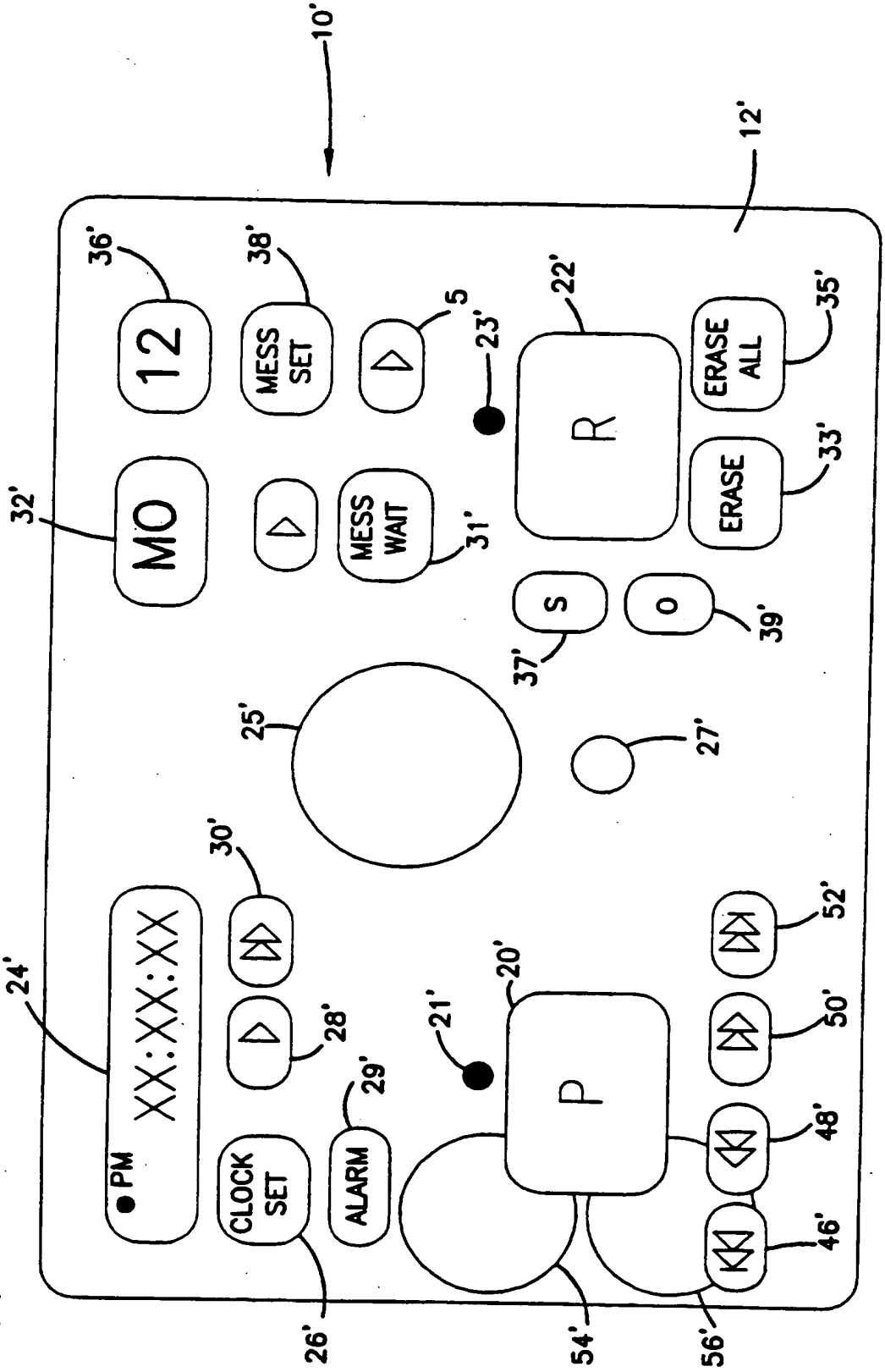

FIG. 14

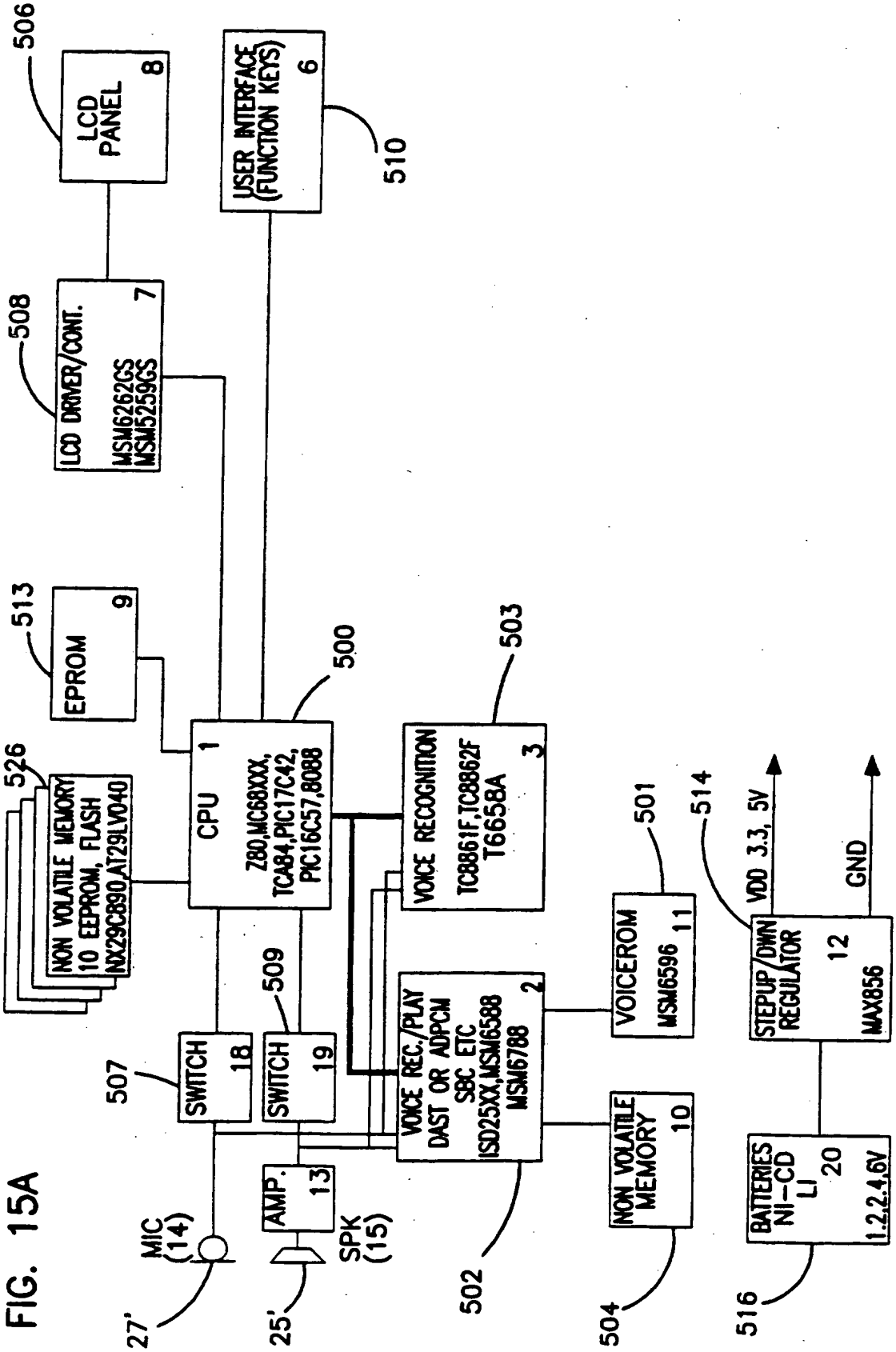

FIG. 15A

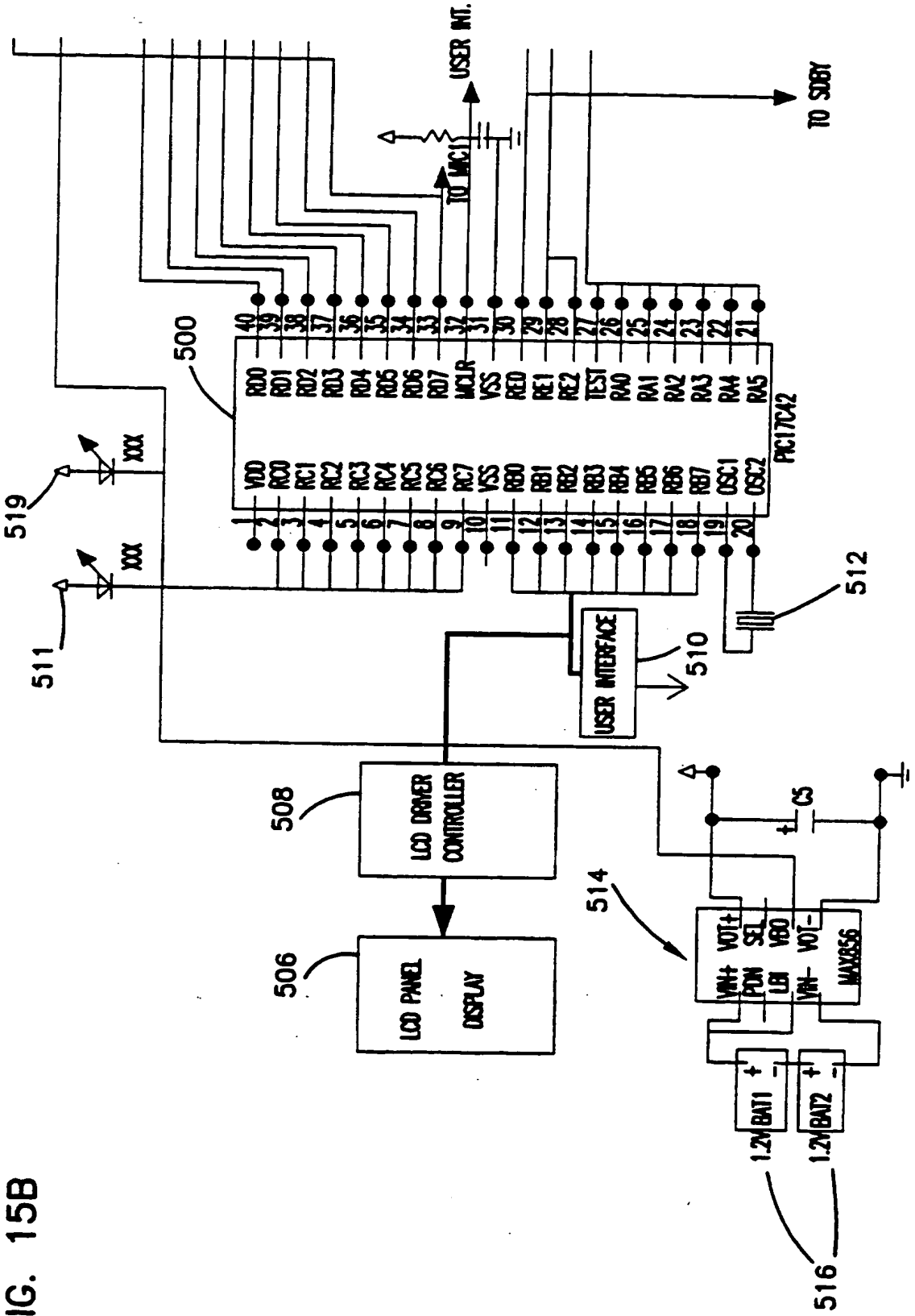
USER INT.
TO SDBY
TO MIC1
500
PIC17C42
519
511
512
510
USER INTERFACE
508
LCD DRIVER CONTROLLER
506
LCD PANEL DISPLAY
514
C5
MAX856
BAT1
BAT2
1.2V
516

FIG. 15B

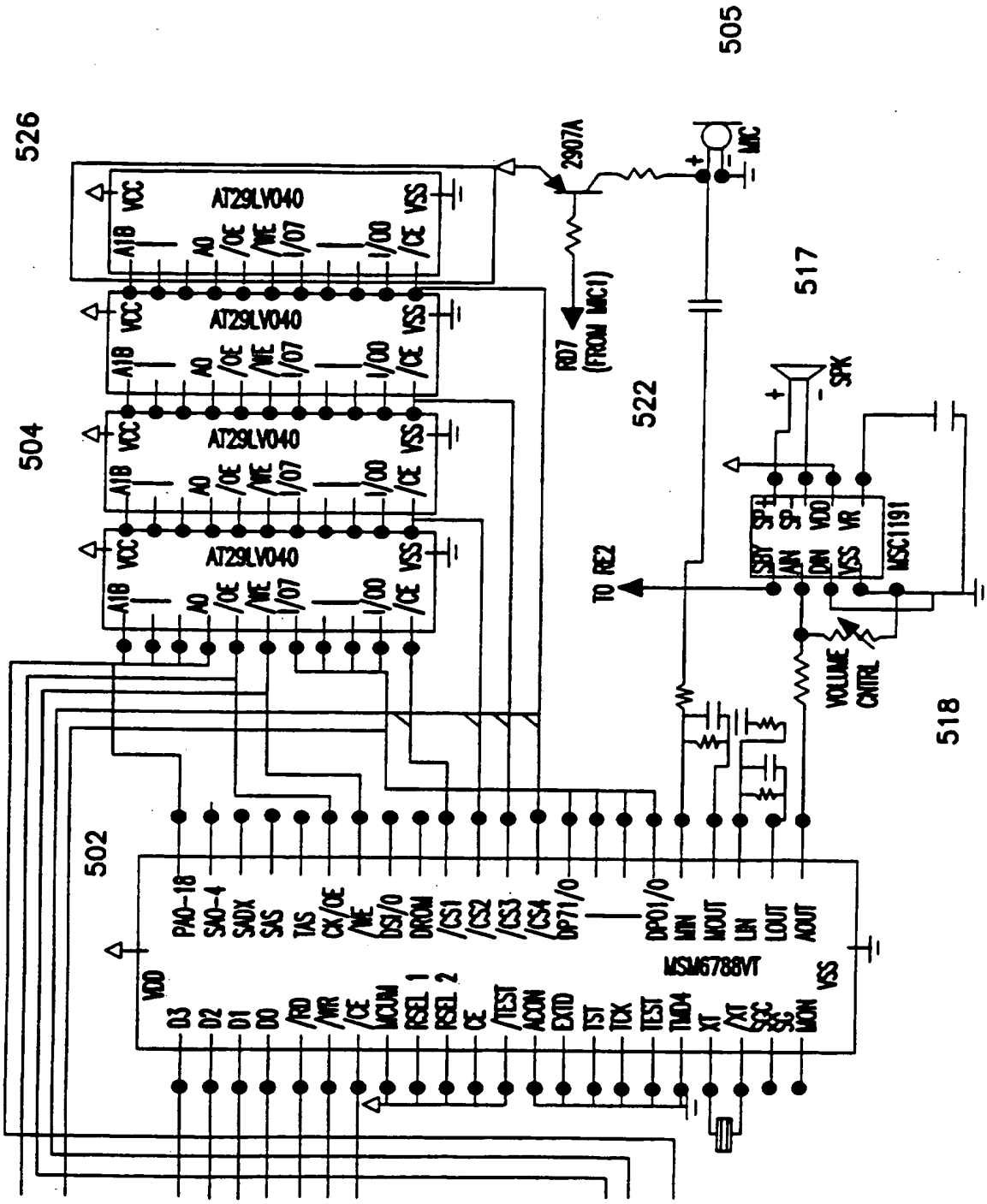

FIG. 15C

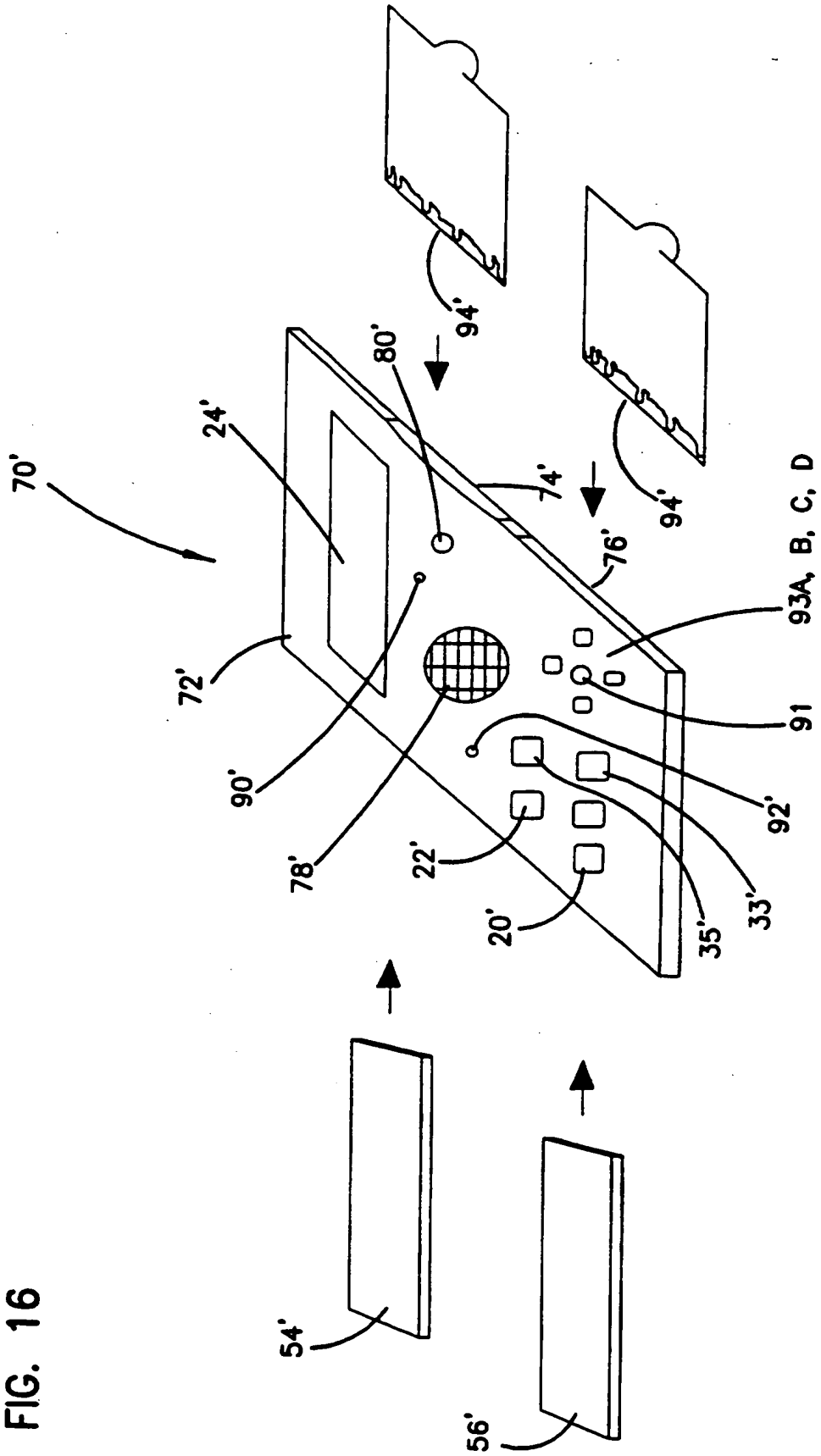

FIG. 16

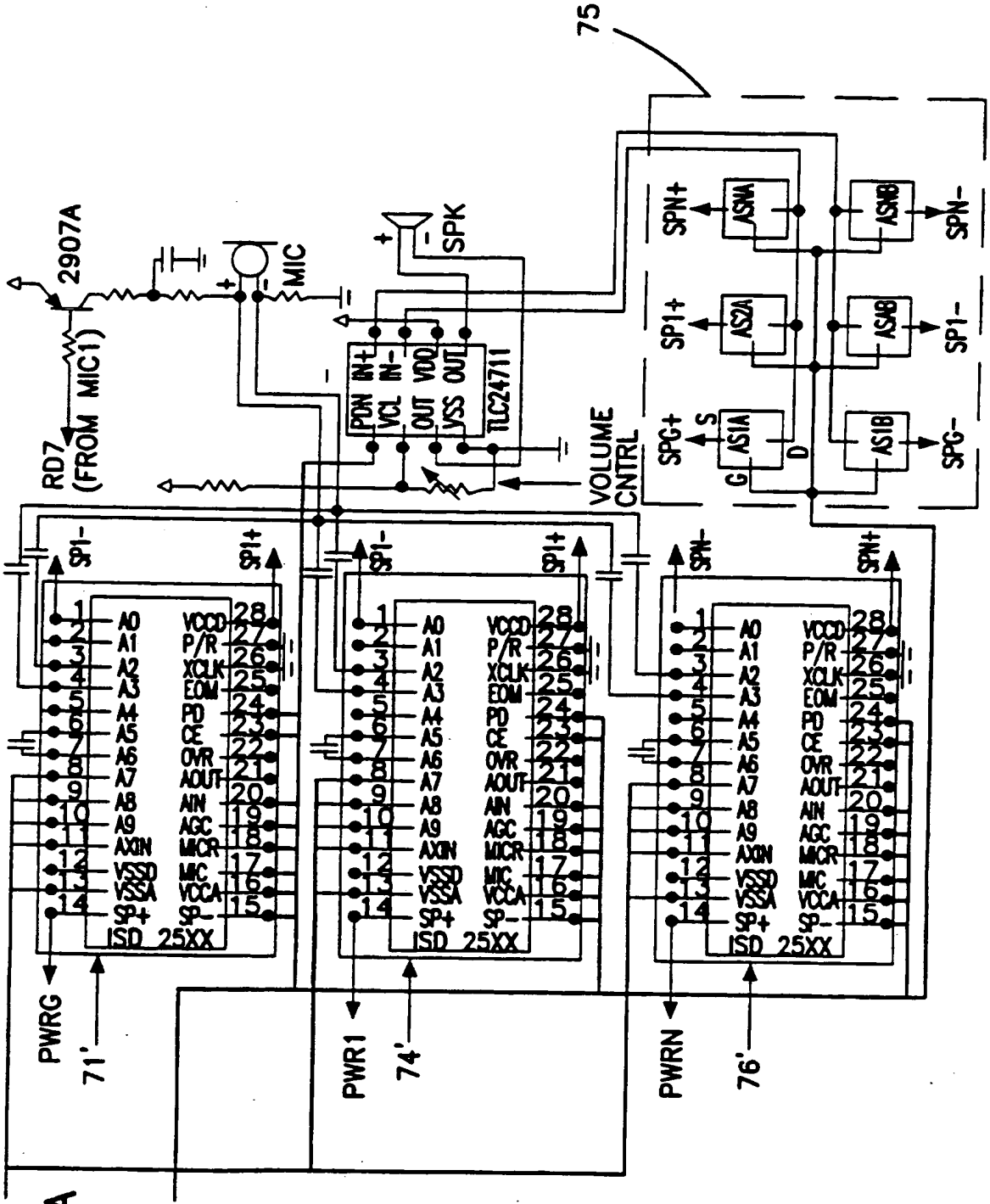

FIG. 17A

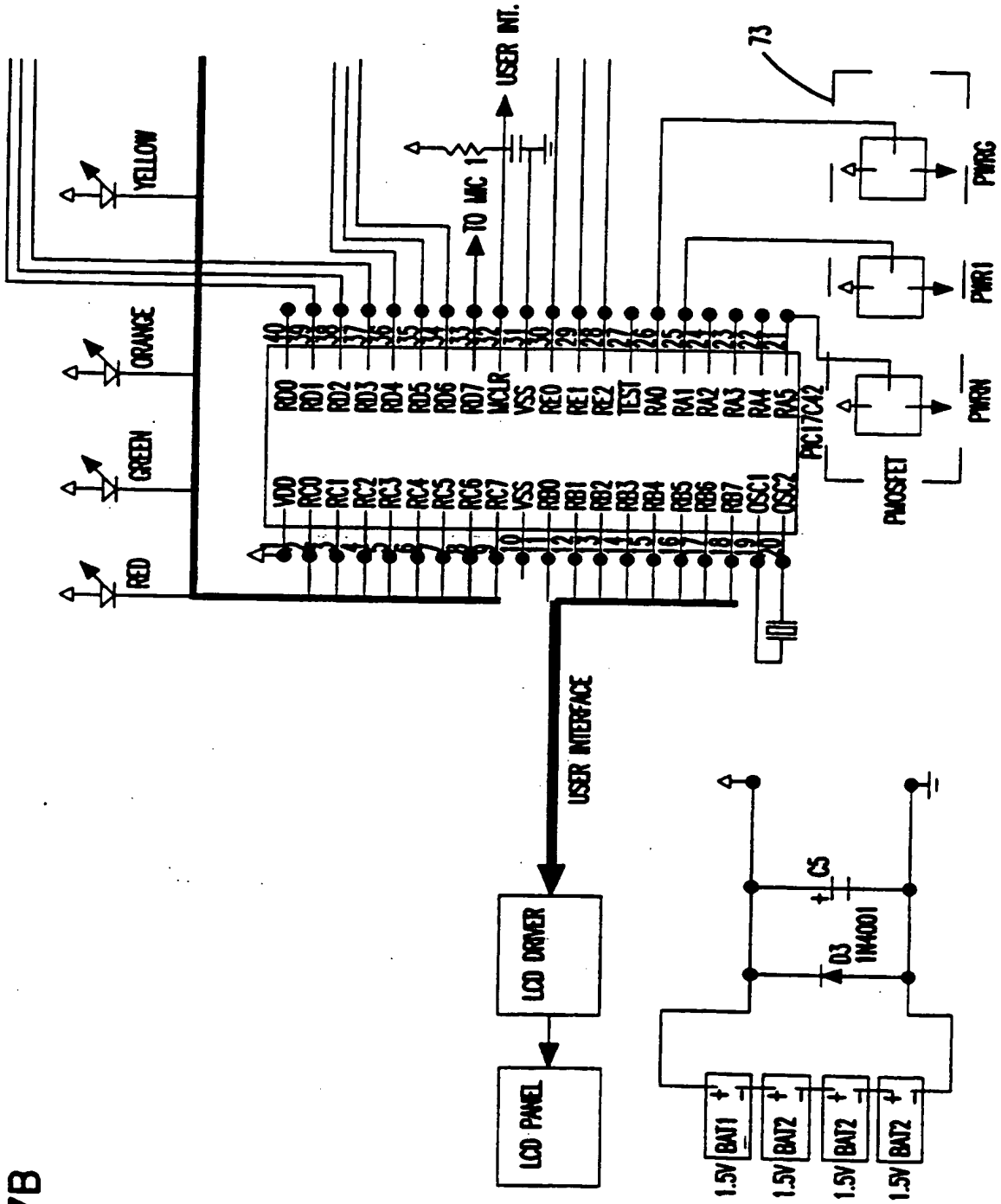

FIG. 17B

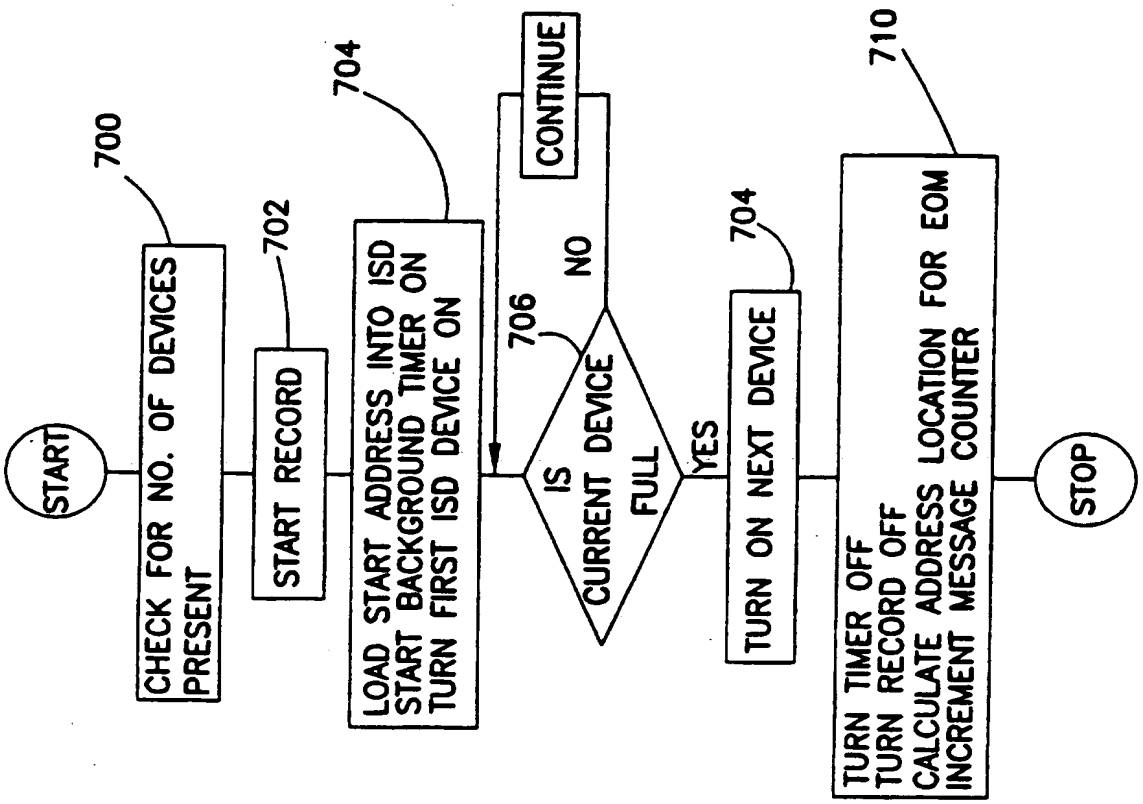

FIG. 18

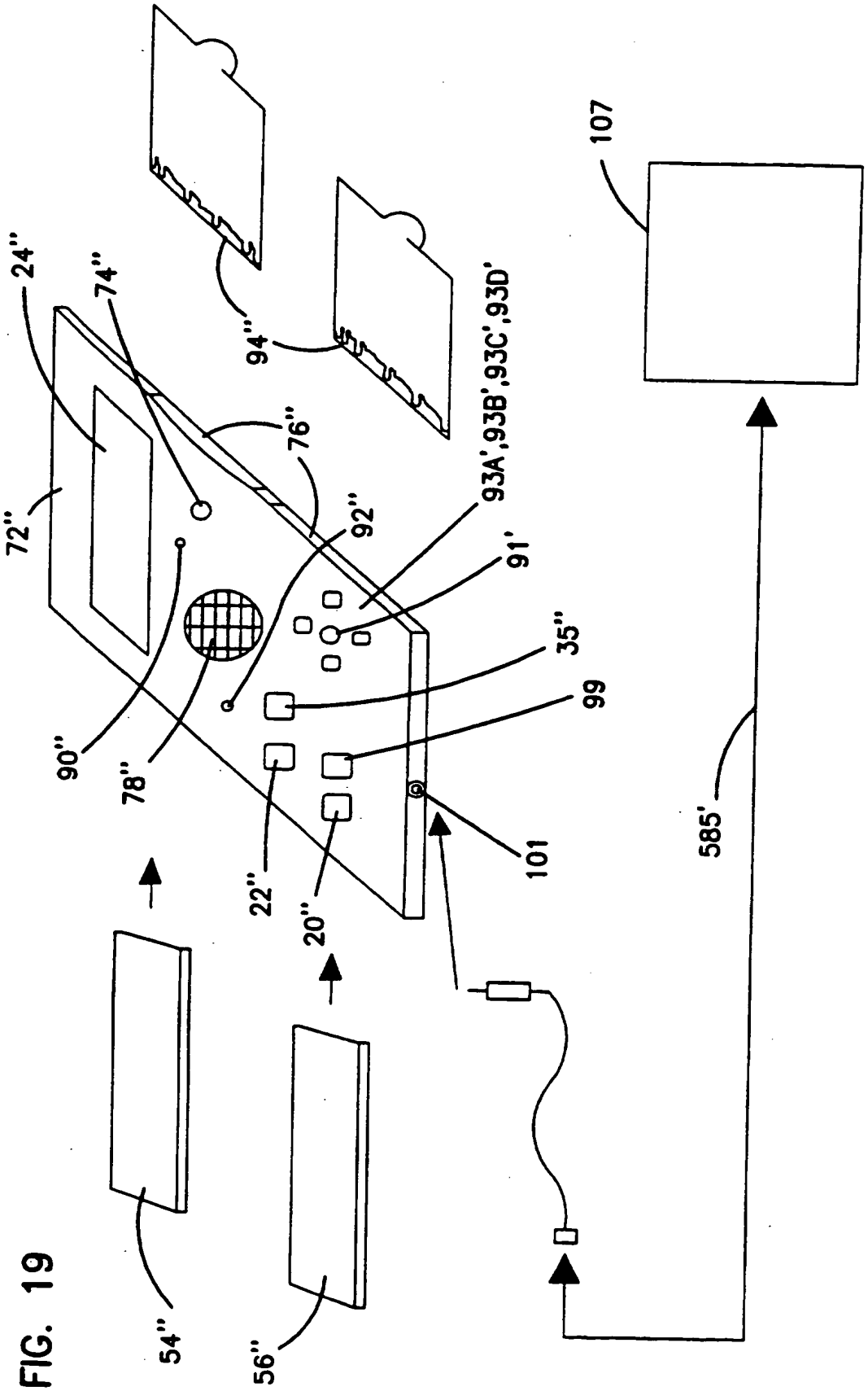

FIG. 19

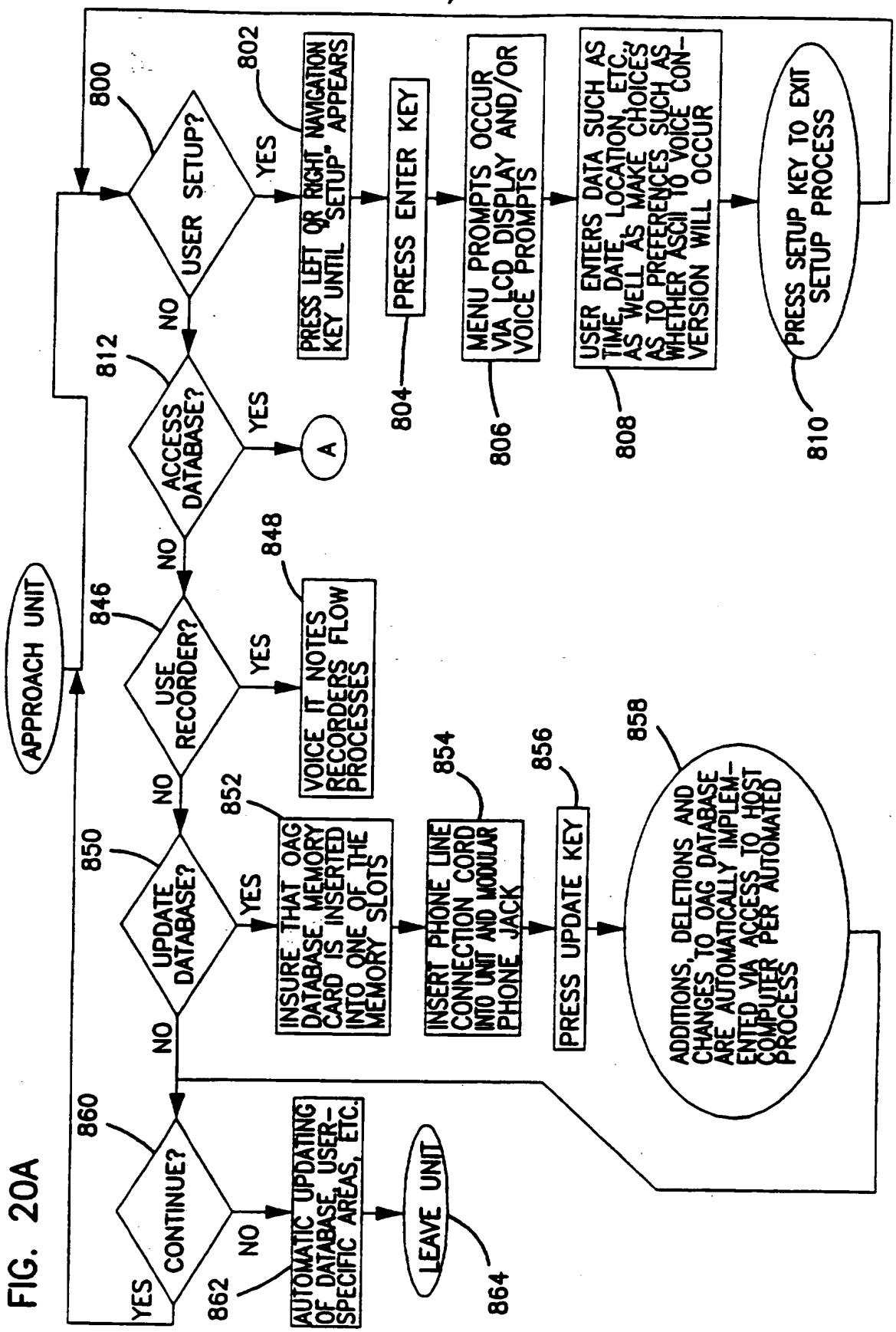

FIG. 20A

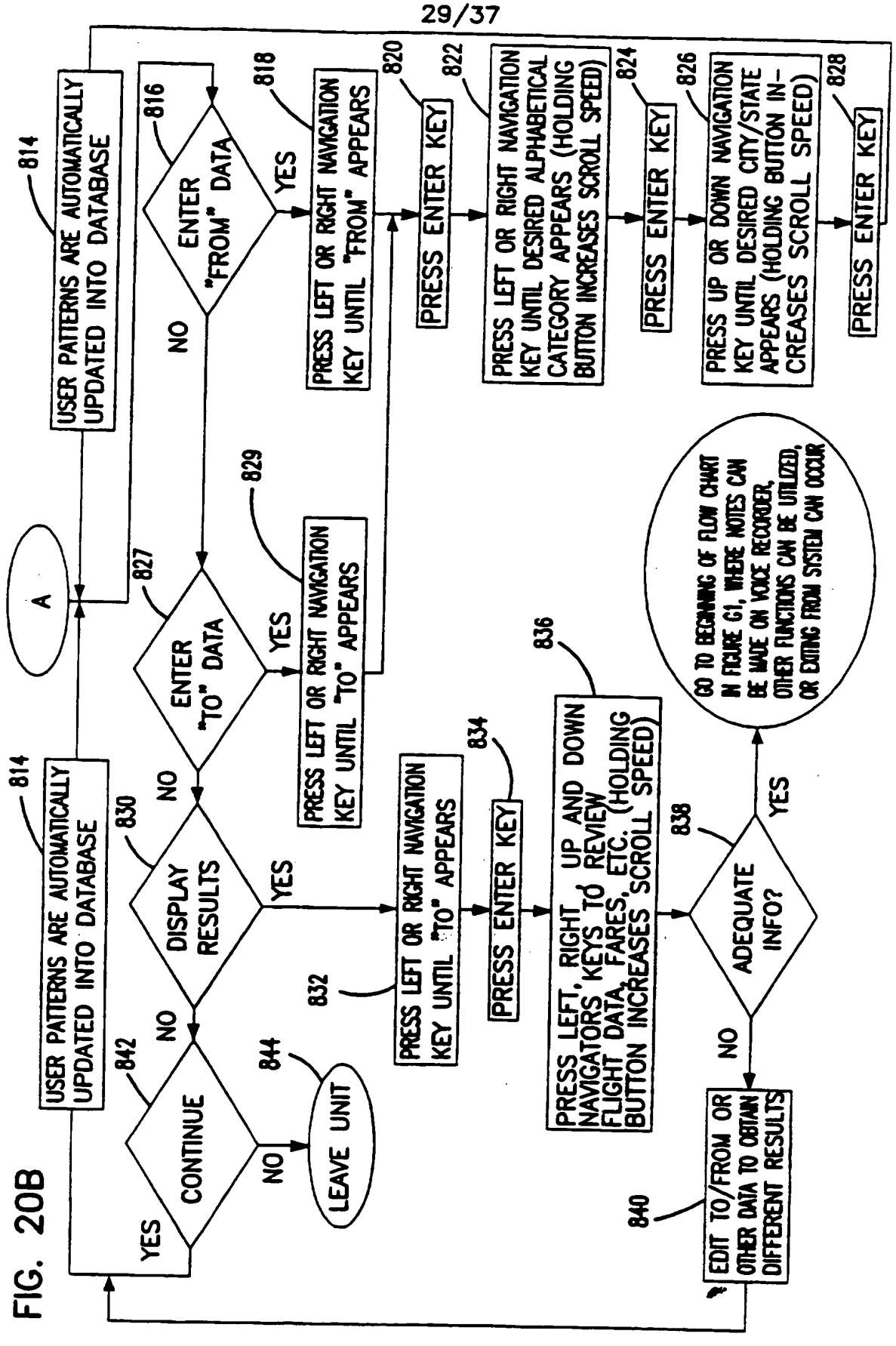

FIG. 20B

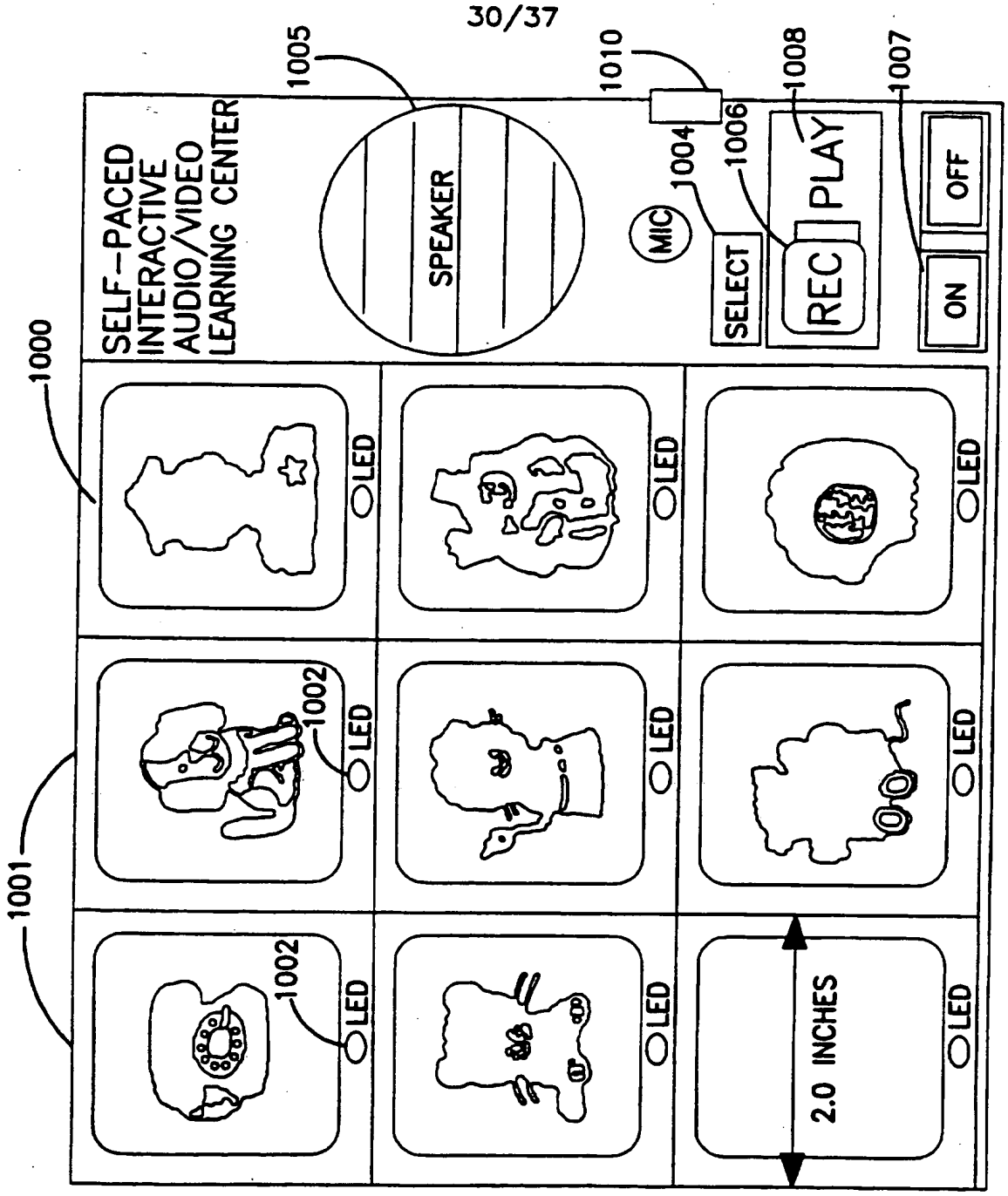

FIG. 21

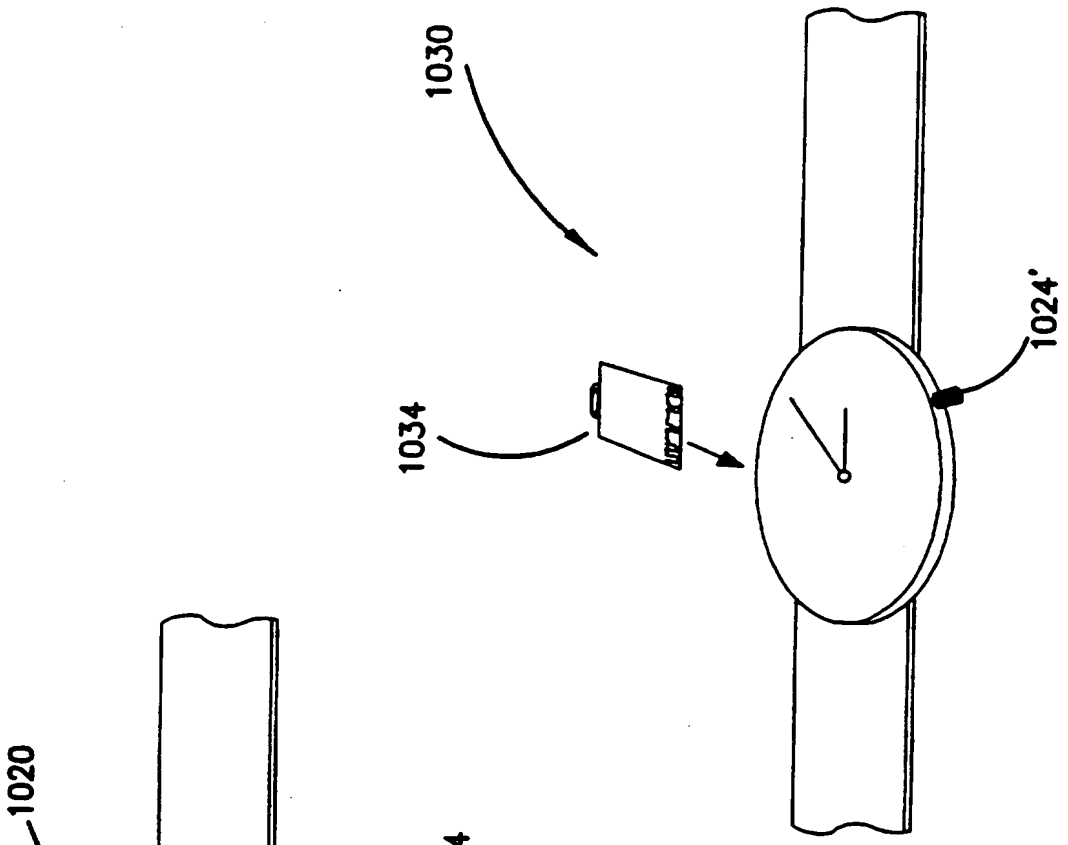

FIG. 23

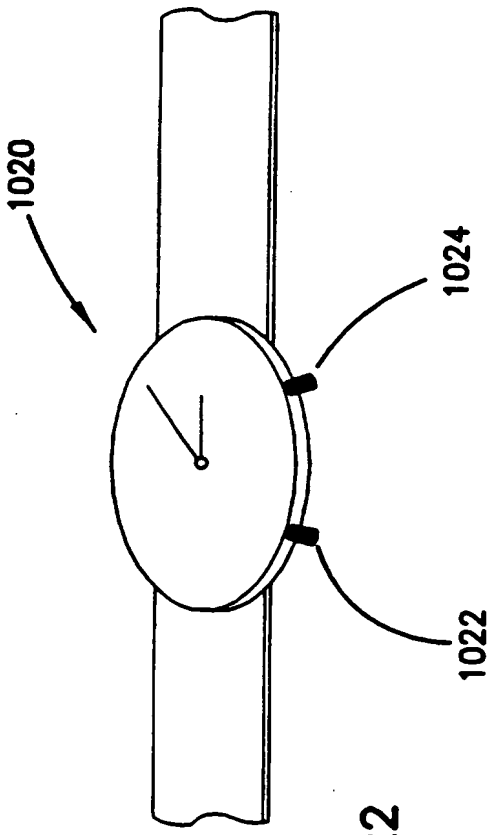

FIG. 22

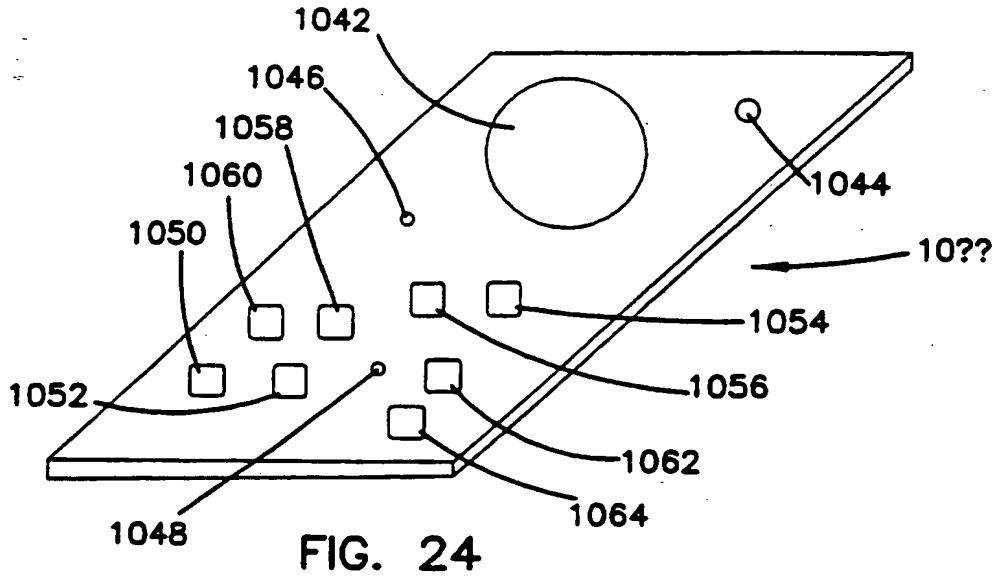

FIG. 24

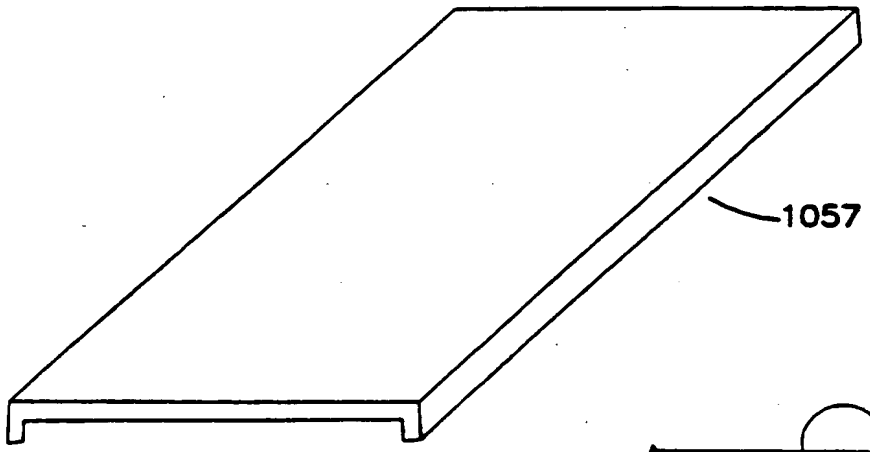

FIG. 25A

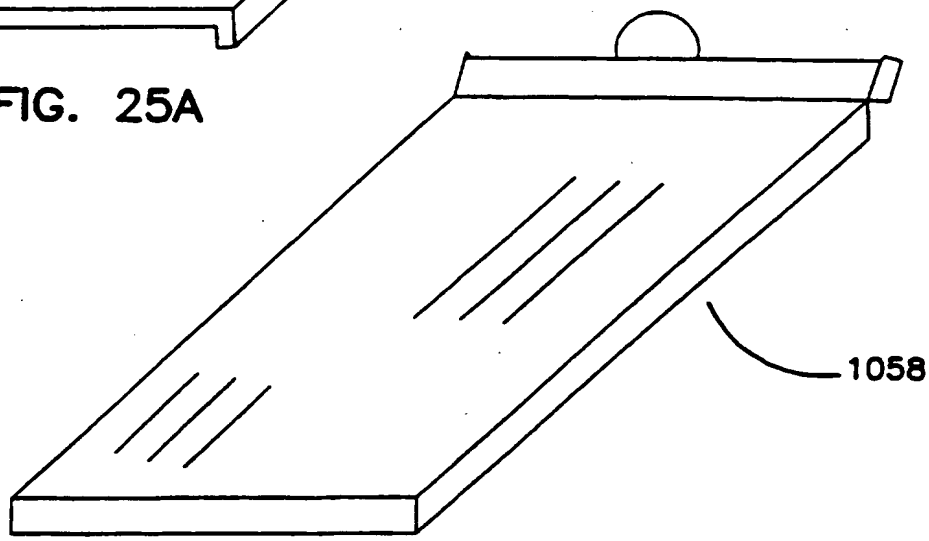

FIG. 25B

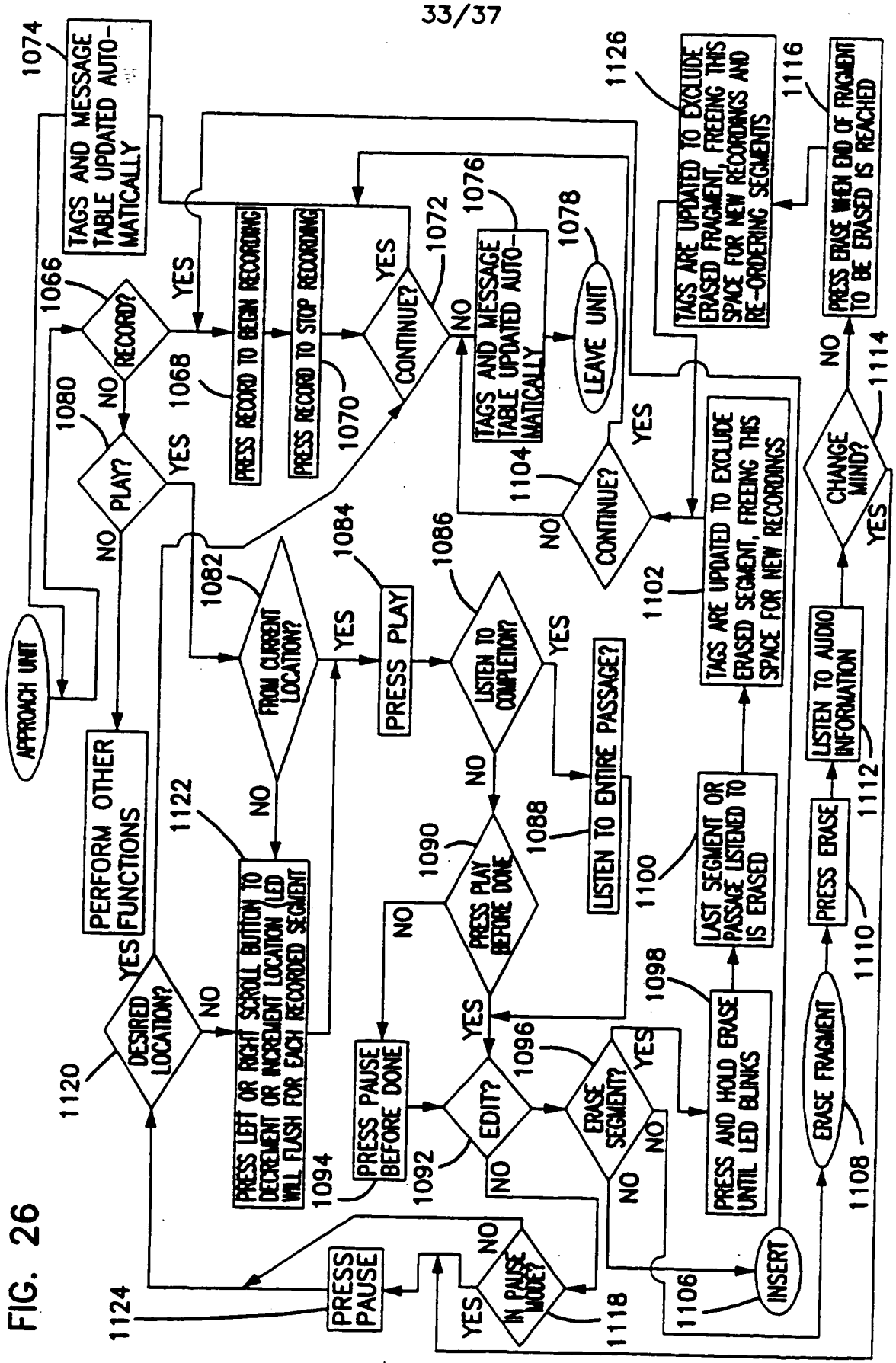

FIG. 26

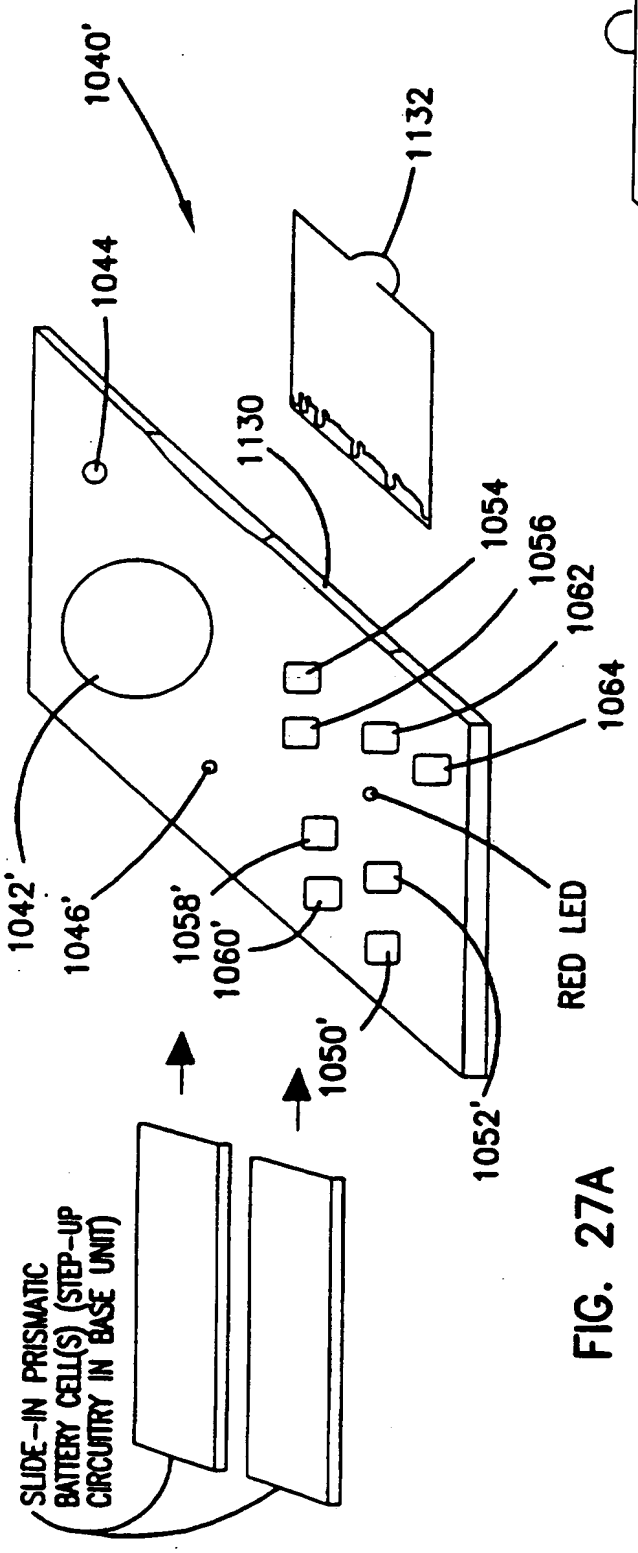

FIG. 27A

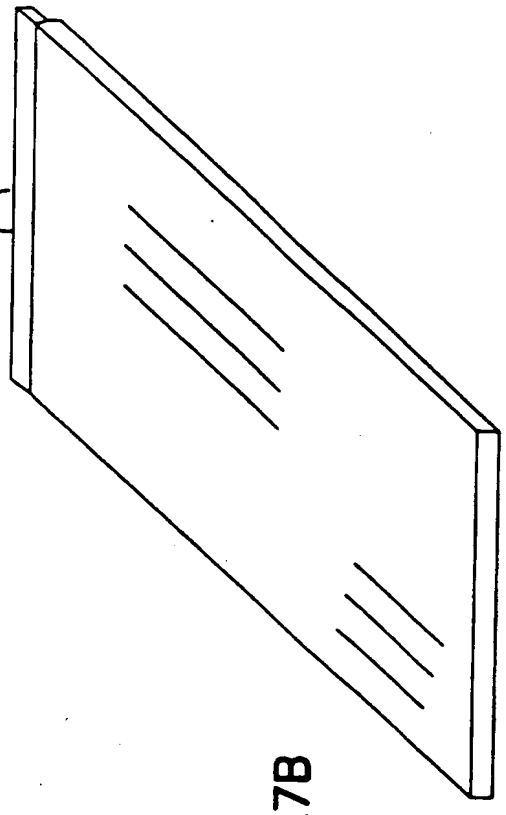

FIG. 27B

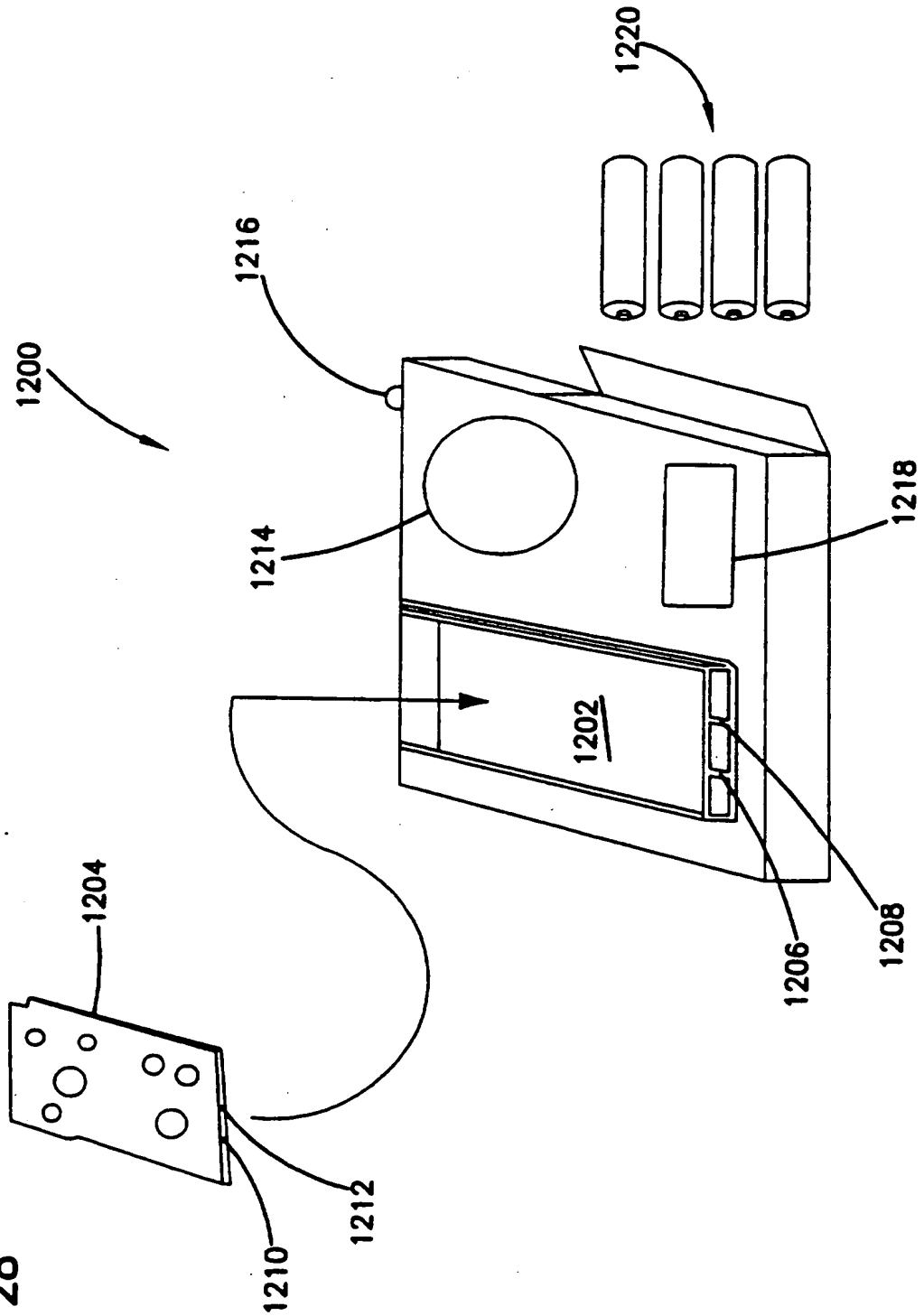

FIG. 28

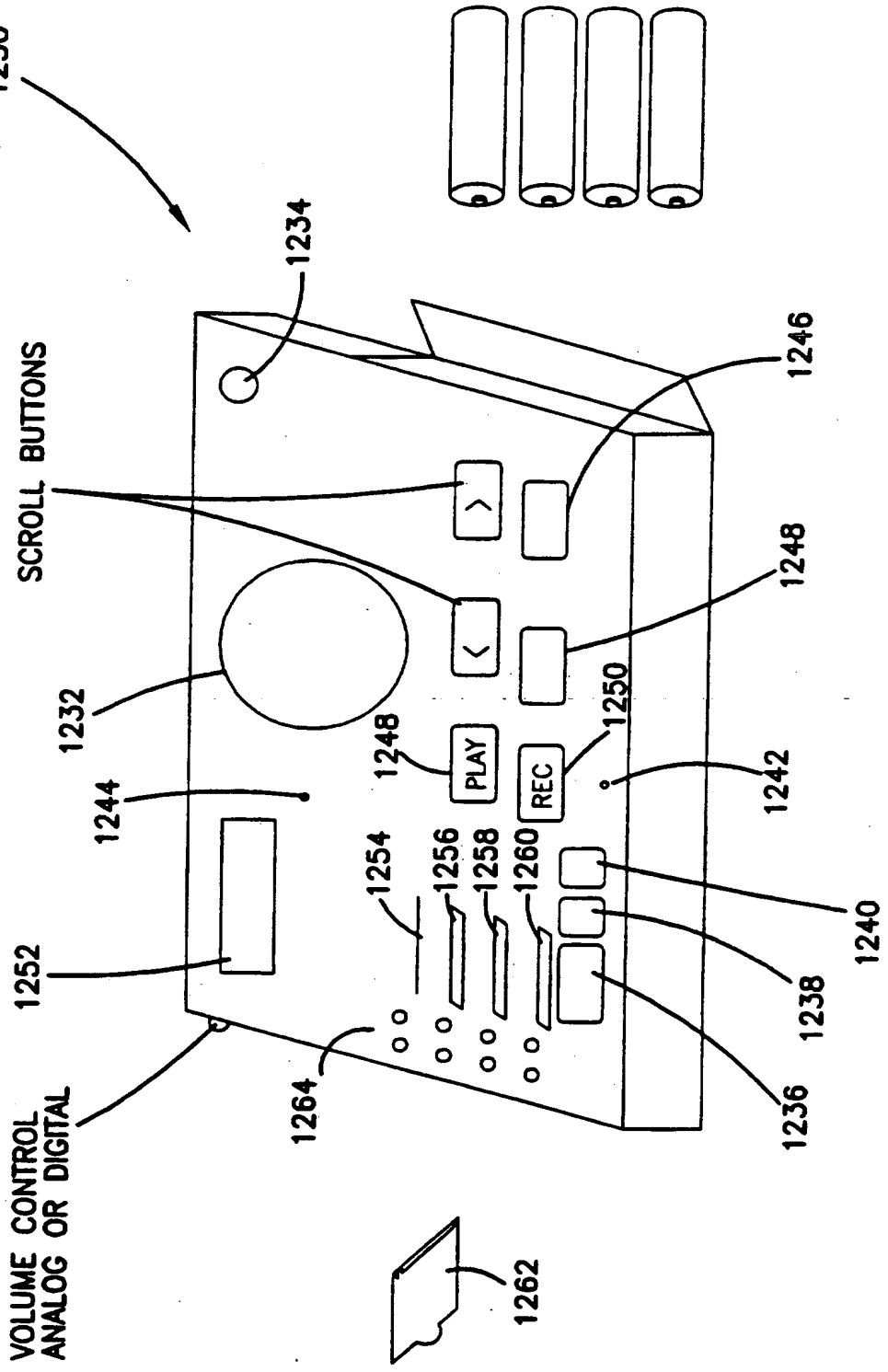

FIG. 29

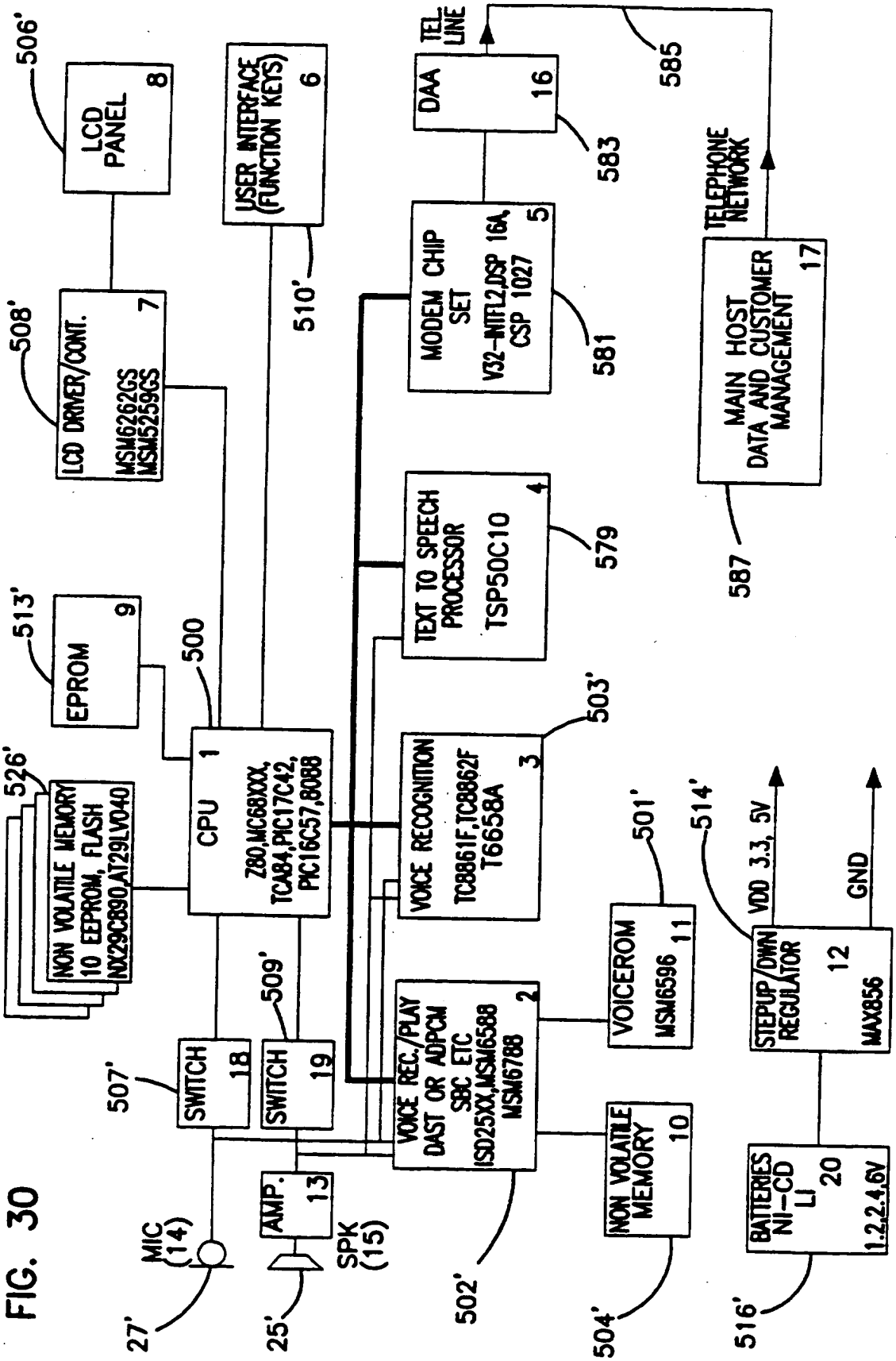

FIG. 30

INTERNATIONAL SEARCH REPORT

Inte...ational application No.
PCT/US95/11479

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G10L 9/00.
US CL :395/2.81.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/2, 2.1, 2.4, 2.67, 2.79-2.81; 381/51; 379/67, 68, 73, 88; 369/31, 63; 446/143, 297, 484, 485; 434/227, 228, 230, 308

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS Text Search: handset#, suction cup#

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	DE, 42 07 447 A1 (HOLZER) 03 September 1992, Figs. 1-7; Abs.	1-6, 8-9, 17-19, 21-23, 26-28 --- 7, 10-16, 20, 24-25
Y	ISD 1012A/1016A/1020A, Information Storage Devices, Inc. February 1992, pages 1-2.	7
Y	US, A, 4,209,850 (TAZAKI ET AL.) 24 June 1980, Figs. 1-2; Abs.; col. 1, lines 46-49.	10-12
Y	US, A, 4,446,335 (LEE ET AL.) 01 May 1984, col. 2, lines 65-67.	13-14

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 11 DECEMBER 1995	Date of mailing of the international search report 06 FEB 1996
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DR. MICHAEL A. SARTORI Telephone No. (703) 305-9600

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/11479

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,791,741 (KONDO) 20 December 1988, Abs.; col. 1, lines 23-28; col. 3, lines 26-35.	15
Y	US, A, 5,164,915 (BLYTH) 17 November 1992, Figs. 15-16; Abs.; col. 24, line 10 - col. 25, line 40, especially col. 25, lines 21-30.	16
Y	US, A, 4,287,568 (LESTER) 01 September 1981, Abs.; Figs. 1-2; Fig. 11, item 34; col. 7, line 66 - col. 8, line 4; col. 5, lines 28-34; col. 7, line 66 - col. 8, line 4.	20
Y	US, A, 5,121,422 (KUDO) 09 June 1992, Fig. 1a, items 4a-c, 12.	24-25